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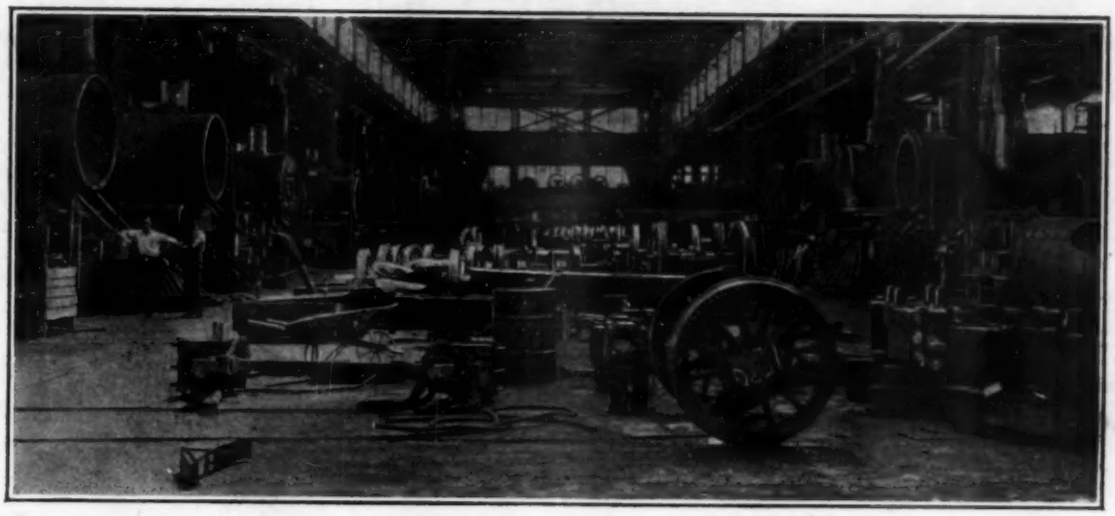


Repairing Locomotives in a Manufacturing Plant

By Howard Campbell
Western Editor, *American Machinist*

Vertical and horizontal milling operations on shoes—Tools for boring air-pump chambers—"Home-made" crank pin turning tool—Boring cylinders and facing valve seats

IN THESE days when the railroads are applying manufacturing methods, as far as possible, to the rebuilding of locomotives, a discussion of some of the methods in use on locomotive work in a production plant will not come amiss. One section of the huge plant of the Minneapolis Steel & Machinery Co., Minneapolis, Minn., has been occupied for some months with locomotive repair operations, some of which are described herewith.

As locomotive work was not anticipated when the building was constructed, no facilities were provided for handling work of this class. The problem was solved by the construction of the gantry crane shown in Fig. 1. Pits were made and tracks were laid in the floor so that locomotives could be backed into either side of the shop and tracks were laid longitudinally for the crane, as shown in the head-piece. The engines are run into the shop on a track at one end of the room, from whence they are transferred to any desired track by the gantry crane, which will handle 250 tons. A traveling crane of smaller capacity handles parts and transfers wheels to and from the balcony at the end of the shop, where the wheel work is done.

As the milling machine is a familiar tool in this shop, it was inevitable that some of what are usually considered planer jobs should be done on the milling machine. Fig. 2 shows how the sides of cast-iron shoes are finished on a LeBlond No. 4 heavy-duty miller, using a pair of 1⅛x11-in. cutters. The cutters turn at a speed of 12 r.p.m., each taking a ¼-in. cut, while the work feeds ⅝ in. per revolution of the cutters. Twenty-five are finished per day on this operation.

After the shoes have been milled on the sides, they are finished inside as shown in Fig. 3, using the same machine and a pair of 1⅜x2½x7½-in. interlocking cutters. A cut ½ in. deep is taken on each side and on the bottom of the slot, the cutters revolving at a speed of 18 r.p.m., while the work feeds 3⅞ in. per minute. Twenty-five pieces are produced in 8¾ hours.

The last milling operation on the shoes is that of finishing the bottoms, as shown in Fig. 4. A Milwaukee milling machine with a vertical attachment is

Fig. 1—Traveling gantry crane

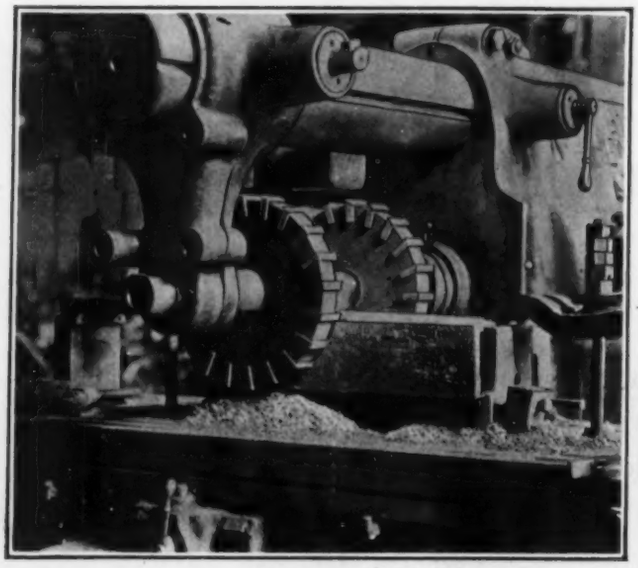


Fig. 2—Milling sides of shoe

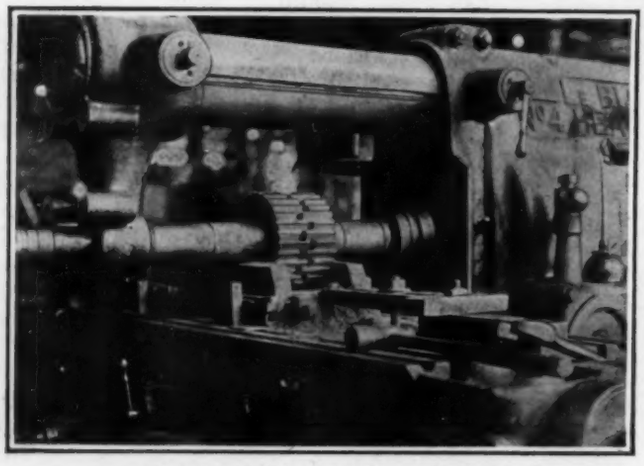


Fig. 3—Milling insides of shoe

used for this operation and the cutting is done with a 1¾x8-in., 16-tooth, inserted-blade cutter. The shoes are laid out to suit the driving boxes in the assembly shop and are machined to the layout. The work feeds 3$\frac{7}{16}$ in. per minute while the cutter takes a cut $\frac{3}{16}$ in. deep at a speed of 16 r.p.m. The operation is completed in 20 minutes, of which the actual cutting time is 12 minutes.

The operation of boring a cast-iron cylinder bushing on a Defiance No. 6 horizontal boring machine is shown in Fig. 5. A head that carries two ¾x1½-in. high-speed steel tools is used, so that the cut will be divided. The cutting speed of the tools is 32 ft. per minute, and the feed is 0.072 in. per revolution. The dimensions of the finished hole are 20 in. in diameter by 40 in. long and the operation takes 6 hr., of which 1 hr. 40 min. is the cutting time.

Another operation that is done on this machine is that of boring air-pump chambers, as shown in Fig. 6. The casting is clamped to the table of the machine and both chambers are bored at one setting. The boring is done with a ¾x1½-in. tool, clamped to a head that is carried on the bar shown in the halftone and in the line drawing, Fig. 7. Only one tool is in use at a time, the tool feeding toward the tail-stock in the chambers in one end of the casting and toward the head of the machine in the other pair of chambers, as designated on the drawing. The tool revolves at a speed of 10 r.p.m. and feeds 0.072 in. per revolution on the roughing cut in the large chamber, while the finishing cut is taken at

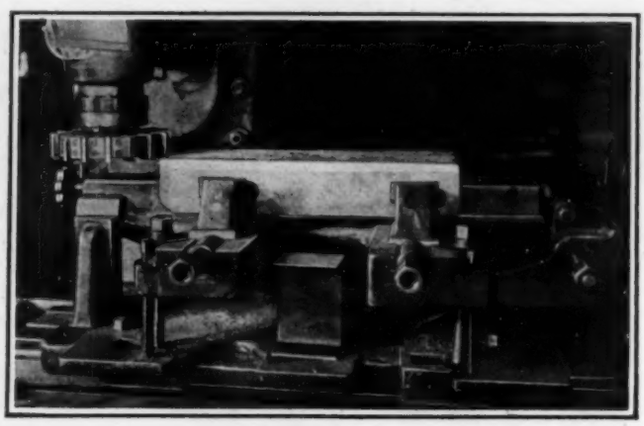


Fig. 4—Finishing bottom of shoe

5 r.p.m. with a 0.160-in. feed. The small chambers are bored at 15 r.p.m. on the roughing cut and 10 r.p.m. on the finishing cut, the feeds being the same as for the large chambers. Just enough stock is taken out in the last cut to clean up. Two castings are finished complete in eight hours with this outfit.

The operation of turning a crank pin with a "home-made" tool is shown in Fig. 8. The tool *A* is held in the end of a bar that is locked in the piece *B*, which slides on the shaft *C*. A cat-head, attached to the end of the shaft in such a manner that the shaft can revolve,

provides means for attaching the shaft to the crank pin, as shown. The shaft is driven through a set of gearing that is operated by an air motor. A feed screw *D* having a ¾-in., 10-P., square thread passes through the piece *B* and, operating with a star feed, feeds the tool approximately 0.024 in. with each revolution of the bar about the crank pin. The tool revolves at a speed of 15 r.p.m., taking a ¼-in. cut. Two roughing cuts and one finishing cut are taken on a pin of average size, the job requiring from 3 to 4 hr. A small pin can be turned in 1½ hr. by means of this device.

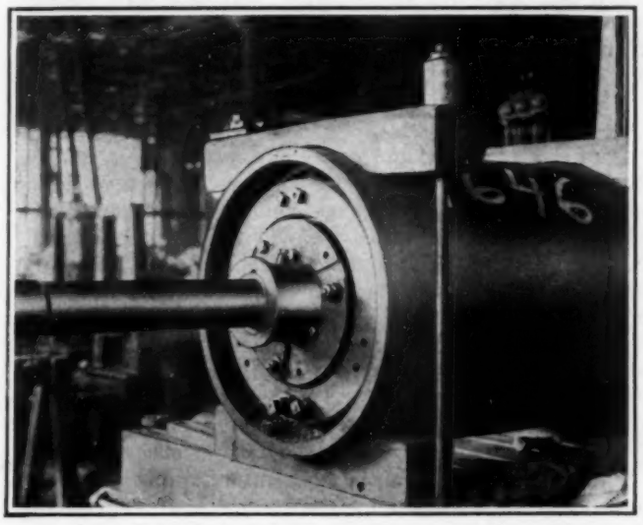


Fig. 5—Boring a cylinder bushing

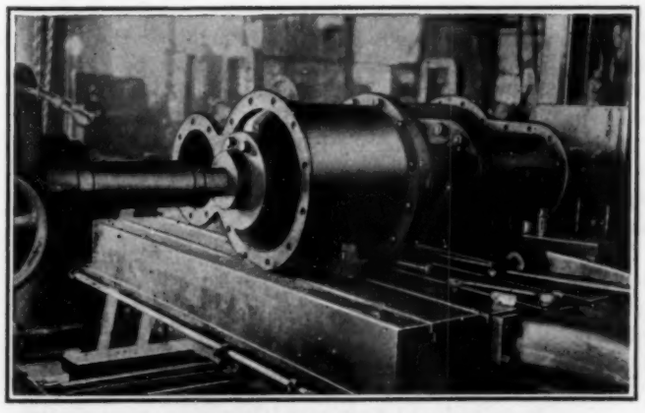


Fig. 6—Boring chambers of air-pump

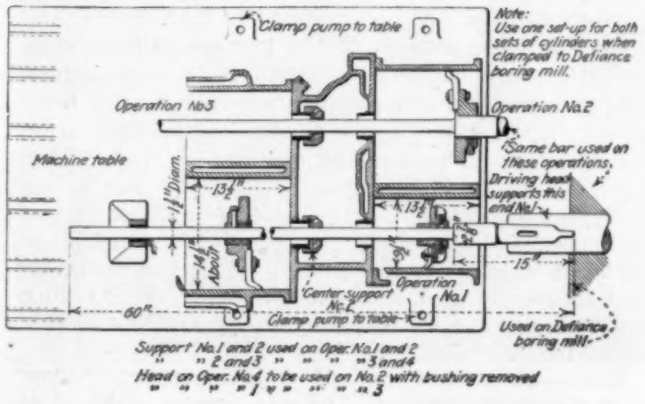

Clamp pump to table
Note:
Use one set-up for both sets of cylinders when clamped to Defiance boring mill.
Operation No.3
Operation No.2
Machine table
Same bar used on these operations.
Driving head supports this end No.1
11" Diam.
13½"
13½"
14" About
9"
15"
60"
Center support No.2
Operation No.1
Clamp pump to table
Used on Defiance boring mill
Support No.1 and 2 used on Oper. No.1 and 2
" " 2 and 3 " " " " 3 and 4
Head on Oper. No.4 to be used on No.2 with bushing removed
" " " " 1 " " " " 3

Fig. 7—Layout of air-pump and boring tools

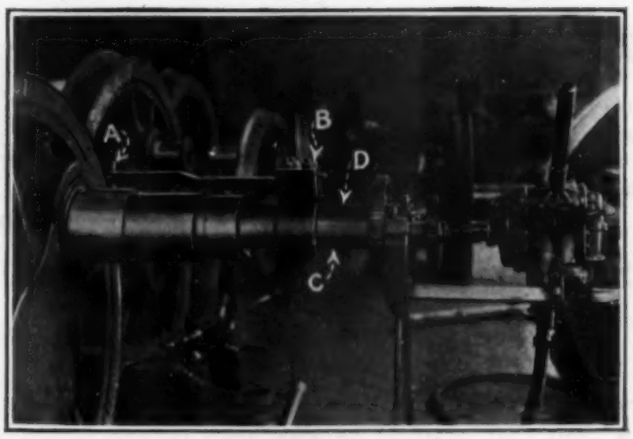


Fig. 8—Turning a crank pin

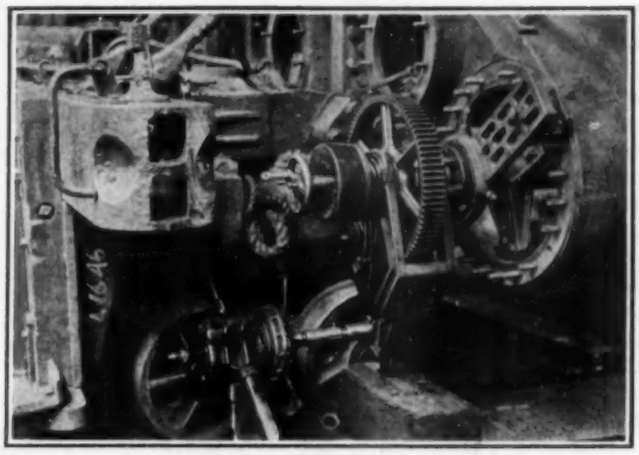


Fig. 9—Portable cylinder boring machine in operation

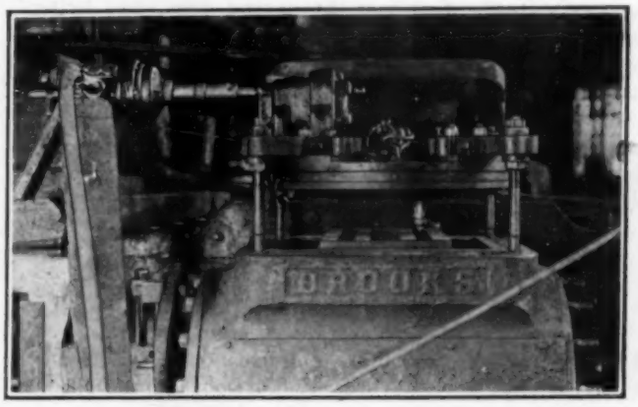


Fig. 10—Facing valve seats

Cylinders are re-bored with an Underwood portable reboring machine, one of which is shown set up in Fig. 9. The cutting tools are located in a head carried on a shaft that is supported by crossheads which are bolted to the ends of the cylinder. The head is a sliding fit on the shaft and is keyed so that while being forced to revolve with the shaft, it can be fed along by the action of a steel square-thread screw that is let into one side of the shaft, and which is operated automatically. Power is supplied from the shop air-line through an air motor which operates a train of gears as shown in the illustration. The ¼ in. of stock is removed in two cuts, the cutter-head turning at a speed

of 4½ r.p.m. and feeding ¼ in. per revolution. Three cylinders can be re-bored in a day with this tool.

Worn valve seats are planed with the Underwood rotary planing machine shown in operation in Fig. 10. The machine is attached by studs to the steam chest, as shown, and power is supplied through an air motor. The tool is attached to the bottom plate of the machine, which revolves when the air is applied. The tool holder is attached to a feed screw that is operated by a star feed, the tool being set, in this instance, to take off just enough stock to clean up with a feed of 3/32 in. per revolution. Unless the valve seat is badly worn, a single cut is usually enough to true up the valve seat so that it will be in good condition for scraping.

Slack-Time Jobs for Railroad Shops

By F. M. A'Hearn

THE problem of utilizing profitably the time intervals that occur in so-called slack periods in the various departments of a railway repair shop is, and ever has been, one of the most important confronting the railway-shop executive. The editorial on page 750, Vol. 60, of *American Machinist* shows careful consideration on the part of the author and fully covers the fallacy of the "home-made tool" enthusiast's argument. Fully substantiating this editorial is the poem by Frank C. Hudson on page 2 of the advertising section in the May 29th issue of the same journal, which describes very neatly in verse the symptoms of the malady that breaks out at irregular intervals in railway shops, and usually runs its course until each succeeding generation of shop foremen becomes immune to the idea that a railway shop can compete successfully with a shop specializing in the manufacture of a certain product. This poem, in the opinion of the writer, should be posted in the office of every railway-shop superintendent in America.

The fourth paragraph of Mr. Hudson's poem in particular, strikes a responsive chord in the heart of the man who chooses to look a disagreeable condition "squarely in the face" as the saying goes, and brings to mind a business admonition well known—"Kid everybody except yourself and your banker." The man making drills, taps, and reamers in the railway shop does not as a rule point out the imperfections of the home-made tool as readily as he does those of the purchased product, thus kidding or deceiving himself and others. We do not mean to say that good tools cannot be made in a railway shop, nor that railway-shop mechanics cannot do good work.

Keeping Departments Employed

The manufacture of certain locomotive parts, with the expectancy of ultimate application to the locomotives handled at a certain division or shop, will furnish a means of keeping certain departments employed, but must be approached in a cautious manner. If not, apparent profits will develop into losses of material as well as of labor. Before it is possible to make spare parts, there must be a thorough understanding between the stores and mechanical departments as to the quantity of material needed in a given time as shown by previous issues, if the spare parts referred to are to be made with a view of saving money for the stockholders.

One of the ways of protection against the slack period, or of counteracting its effects when it occurs, is to study the condition of the motive power carefully and to be enabled at all times to know approximately how many locomotives of the various kinds in service will undergo classified repairs in a given period of months or years. This knowledge will enable the supervisory forces to know, not only what new driving boxes or rod bearings will be required, but also how many fireboxes, locomotive frames, cylinders, cabs, or tenders will be needed on or before a given date.

How the Work Can Be Planned

We may plan a repair program to cover fifty locomotives of a given type and order our materials in quantities to cover lots of five locomotives. More or less than five may be our basis as conditions warrant. If we adhere to this practice we will not find a surplus of material when the program is completed. The surplus material problem is even greater than that of home-made tools, as the inventories of railway stores departments will show, since it is not uncommon to find two, five, or even ten years' stock of unapplied material of certain types. This condition is uncalled for and will not exist if the respective departments are giving proper attention to finished materials.

Standardization of sizes and interchangeability of parts may be developed by the mechanical department as an aid to making up of parts for light running-repair operations, and even for classified repairs. Driving-wheel sizes may be maintained to standard dimensions and all new tires bored when received from the maker, or at the first convenient time subsequent to their delivery. Driving-box shoes and wedges may be carried in stock finished, except the fit against the box. Cylinder packing-rings are finished in sizes varying by ¼ in. in cylinder diameters. Piston-head tee rings may be finished all over, except cylinder fit. Main rod bearings will be interchangeable if original strap sizes are maintained.

Even in the matter of unfinished materials, the mechanical department must aid the stores department in the intelligent selection of stock sizes of plates, bars, bolts, cotters, structural shapes, and all similar materials. A recent survey of a stock list showed twenty-one sizes of rough turned driving axles carried in stock. The sizes were reduced to nine without excessive waste in finishing. Firebox and boiler-steel plate sizes were reduced from sixty-five to thirty-two, and a proportionate reduction was accomplished in tank sheets.

The idle time problem of the average railway shop must therefore not lead to attempts to manufacture tools or even special locomotive appliances at a loss; neither should it lead to the purchase of castings or of raw materials to be finished and to lay in stock for indefinite periods, but rather it should be met by an intelligent analysis of existing and of probable future conditions, and the slack time of men and machines employed in such manner as to produce the materials most frequently used, even though the apparent saving is not so great as may appear when building tools or special parts.

Again—do not kid yourself or your banker. Follow Davy Crockett's precept—"Be sure you're right, then go ahead."

Routing and Handling Material
in Making a Quarter-Horsepower Motor

By L. C. Morrow
Managing Editor, *American Machinist*

Concluding operations on brackets—Rotor operations —Rotor and stator cores—A continuous-type enameling oven conveys the housings to assembly floor one flight up

RACKS of parts upon which drilling has been performed are stacked to the right of the Natco, to be reached easily by the next operator, whose machine, a Greenerd arbor press, is shown in the background of Fig. 6 and again in Fig. 7. On this machine the shaft bushings are pressed in. The man who operates the press also runs the sensitive drill press adjacent to it, where he drills an oil-drain hole and two angular oil-cup holes. On the other sensitive drill another operator taps the hole for the oil-wick guide tube and countersinks the lead holes. He also operates the Becker vertical miller, on which the starting-switch mounting bosses are profiled. The ease with which the two operators can handle the brackets is apparent.

At this point there is a break in the continuity of the illustrations. The operations not shown are tapping the oil-cup holes, screwing-in the oil-wick-guide tube and reaming the shaft bearings. The machines on which these operations are performed are located so that the work continues to flow in a straight line and progress to the grinding operations shown in Fig. 8 is by the same easy steps that have characterized the routing up to this time.

In the sixth group of operations the face of the bracket is ground on a Landis machine and the periphery is ground, from the rough, on a Norton cylindrical grinder. One arbor remains in the bracket during the two operations and one operator handles the two machines. Production is 500 brackets per day of 8¾ hr. Upon completion of these operations, which conclude the machining, the racks of brackets are piled on electric-truck platforms and are transported to the inspection bench.

After inspection, the frame and front and rear brackets are temporarily assembled, bolts are inserted, and the assembled unit, constituting the housing, is sprayed. It is then loaded into the continuous-type enameling oven illustrated in Fig. 9. The oven, in addition to its primary work of baking on the enamel, serves the purpose of transporting the housings to the floor next above, where assembly takes place. The first unit of the complete motor, outlined in the diagram on page 291 is thus disposed of.

The shaft job, with the exception of the turning

Second part of the article. The first part was published on page 291.

Fig. 7—Fourth group of operations on brackets

Two operators run four machines, pressing in shaft bushings, drilling oil-drain hole and two oil-cup holes, tapping oil-wick-guide tube hole, counter-sinking for leads, and profiling starting-switch mounting bosses.

Fig. 8—Sixth group of operations on brackets (fifth group not illustrated)

On the two machines shown the face and periphery are ground. These two operations complete the machining of the brackets, which are taken, in racks, to the inspection bench, on electric trucks.

Fig. 9—Continuous-type enameling oven

The housings (frames and brackets bolted together) are baked in this oven after being sprayed. Outlet from the oven to the assembly floor. The oven acts as a conveyor between first and second floors.

Fig. 10—Machining the shaft

On the four machines shown, plus an additional grinder, the pulley flats are milled, large diameter is ground, serrating is done and the bearings are ground. The shaft is completed in this group.

operation, is done across the aisle from the frame job. The equipment consists of the machines shown in Fig. 10 and a Norton cylindrical grinder not illustrated. Turning is done in the screw machine department.

Shafts are contained in metal boxes with sides of wire screen, a construction used solely for the purpose of cleaning. Hot soda water is the dipping solution and the center holes are cleaned by air blast. Transportation of components from machine to machine is accomplished by sliding the containers along the benches or floor.

The pulley flats are milled on the Becker vertical milling machine shown in the left-hand side of the illustration. A multiple rotary fixture is used and the operation is continuous. The larger diameter of the shaft is then ground on the grinder next in line and the shafts are passed to the punch press where the part of larger diameter is knurled. Although this operation is called knurling, it is possible that serrating would be a better term. The grooves are parallel to the axis of the shaft and are fairly deep. The object of the serrations is to provide a large number of small keys to hold the shaft in the rotor, into which it is pressed during assembly. After knurling, the bearings are ground on two Norton cylindrical grinders, one man caring for the two machines.

Laminations for the rotor core are punched in the press department and are delivered to the machining department on rods as shown in Fig. 11. The cores are built up by weighing, the scales being automatic to

Fig. 11—Operations on rotor core in machining department

The laminations, received from the press department, are weighed, tie-pins and resistance rings are applied, pins are staked, and rotors are soldered. Drilling and tapping the holes for the switch conclude the operations in this department. Note the signal-lamp, on scale, in right of illustration.

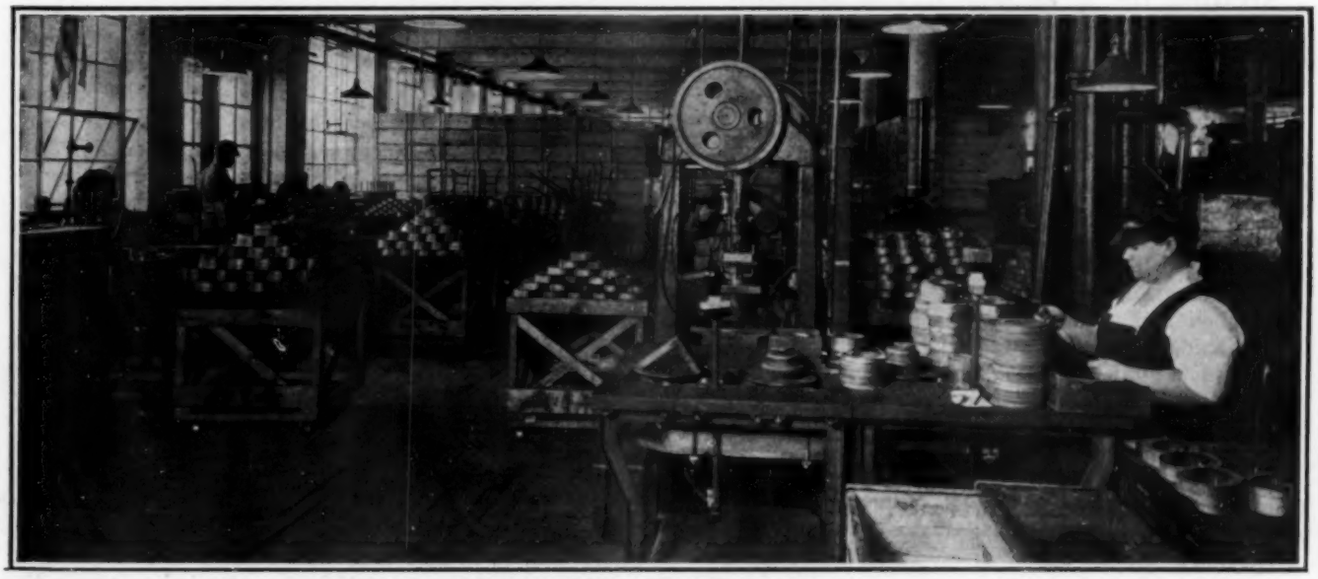


Fig. 12—Operations on stator core in machining department

As in the case of the rotor core, the laminations, received from the press department, are weighed. Mounting studs are inserted, the nuts are tightened while the core is under pressure and the outside diameter is ground. The cores are then sent to the floor above to be wired.

the extent that a red light flashes when the last necessary lamination has been added. In the illustration the girl who is seated is doing the weighing. The red lamp is mounted on the bench in front of her.

The girl at her right is applying the resistance ring and inserting the tie-pins. Staking of the pins is done by the man with the hammer. Another group, going through the same operations, is located to the rear of the group described. Both staking operators place their rotors on the incline along the wall, down which they roll to the soldering operator, who dips them and places them on a receiving truck.

To the left of the soldering furnace is a two-spindle sensitive drill press on which three holes for the switch are drilled and tapped. Switches and fans are applied during assembly on the floor above, and inasmuch as they are produced for the most part in the press department, mention only is made of them here. They are sent directly to the assembly floor, and when added to the rotor core complete the rotor, the second unit shown on page 291 in the diagram.

Stator Core

In building-up the stator core the laminations are matched and weighed, and a scale with the red signal lamp is used, as on the rotor core job. In Fig. 12 this operation is shown in the foreground. The mounting studs are inserted at the same time.

When the nuts on the mounting studs are tightened, the laminations must be squeezed together and a Lucas power forcing press is used, operating to give a pressure of six tons. The nuts are tightened by means of a portable electric drill. This operation and the next, grinding the outside diameter of the stator, are shown in the illustration. A Landis cylindrical grinder is used. For the stator-core work the laminations are conveyed to the first operation in boxes. From there on they travel on the trucks shown, which are constructed to carry the work at about the height of a bench. From this group of operations the stator cores are sent to the next floor to receive the coils and wiring.

Getting the Best Men in the Machine Business—Discussion

By George S. Harris

Obviously Wm. Newman in his article on page 139, Vol. 61 of the *American Machinist* enjoys "free speech" and has come out "boldly" enough to please any machinist by stating that "the machinist is the poorest paid animal that works with his hands in conjunction with his head for his employer."

After carefully reading his article I have confidence in the belief that all of us as machinists quite agree that considering cost of tools, training and responsibilities incidental to precision work 71c. per hour indicates poorly paid animals when compared with $1.50 per hour being paid animals for piling brick and dobbing plaster and paint.

But I fail to see the need of reviewing these obvious facts with which all machinists are familiar unless Mr. Newman had in mind some way of correcting this deplorable condition which he forgot to mention.

It might be true that at this particular time there is no incentive for a young man to learn the machinists' trade when it takes two hours of his labor to hire a bricklayer. A machinist may never hope to own a home when he has to pay such high prices for other labor necessary in its construction.

A machinist may be discontented because of having to work in poorly lighted, poorly ventilated shops among grouped machines around which are strewn ugly-looking castings and forgings on the dirty greasy floors; he may be unhappy on accepting his pay envelop which contains less than one-half what other skilled animals receive. But in view of all this and more—indisputable facts as they may be, what benefit, financial or mental, is derived by this continual growling?

Why should we as machinists growl because we now happen to be the under-dog? Is it because our high-brow dignity prohibits us from facing our present temporary condition as real men? There was a time not so long ago when the plasterer, the bricklayer, the carpenter, were the under-dogs. They also growled and howled in vain, and it was not until certain changes came about, due to changes in supply and demand, that their proportion of long greens changed in relation to other classes of labor.

When as machinists we were the aristocrats of labor we did not bother our heads about the growling of other classes of workers. Why should they bother their heads now? Seen from this point of view, if we were not big enough to offer a helping hand when they were the under-dogs, we certainly have no moral right to attack them now as they enjoy an improved temporary condition over which neither has control. In fact, all such unwarranted impositions reflect our ignorance as machinists of the real cause or causes underlying these long green fluctuations.

Let the Machinists Carry the Hod

Mr. Newman has done well in his presentation of well-known, popular facts concerning the compensation of machinists in comparison with other classes of labor, but it does not require a very high imagination to see that machinists can never shorten the route to more long greens by inferring that the machinists are underpaid because the bricklayers, plasterers and others are overpaid. If this is the lesson we learn, it is up to every machinist to lay down his micrometer and its responsibilities and get a job at hod-carrying or some other high-paying kind of work where we can get more long greens.

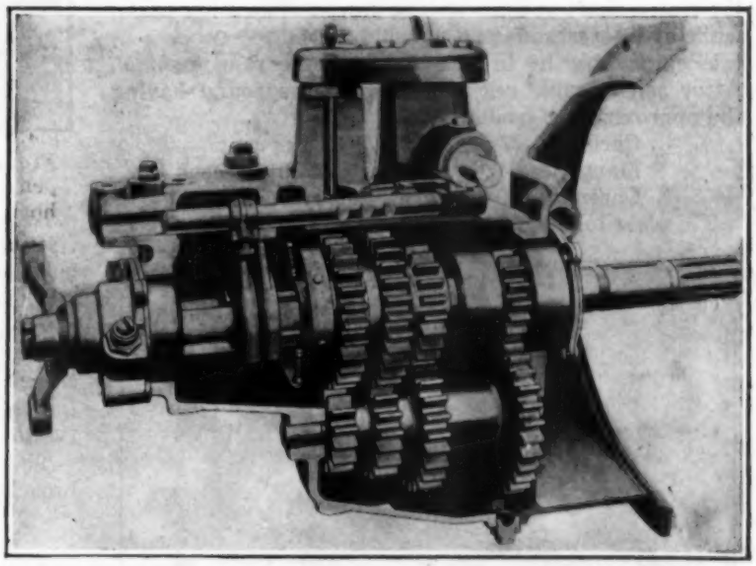
Experience along this particular line has taught that when hod-carriers are scarce, due to obvious reasons, competing for hod-carriers forces the price for this labor upward just as at present, and conversely, when the demand for this labor fluctuates downward, due to less work to be done or due to too many entering that line of work, competing with one another for the same job as it were, we all know or should know what happens to the pay envelop.

In view of this, should there be many machinists determined to get more long greens easily and without the exercise of skill, they now have the golden opportunity before them. The requirements are simple. Compete with the hod-carrier for the same job and satisfy yourself that the law of supply and demand is still in perfect working condition.

While it is true the machinists are comparatively underpaid, it is also true that society is not ready to consider equal remuneration, so why try to upset the orderly fluctuations of competition to which we subscribe?

Automotive Production

A Study of an Unusual Transmission



By John Younger
Associate Editor, *American Machinist*

A CASUAL survey of the Chandler traffic transmission, shows that in design, manufacture and construction it is well worthy of full investigation. The outstanding feature is that the gears are always in mesh and that no dog clutches are used to engage the proper pair. Instead there is a most ingenious system of pawls which can be made to slide to a pre-determined position and lock themselves on the particular gear required. In actual practice this means that in driving there is no clashing of gears and changes can be made with equal facility up or down. The most difficult feat of all, namely to change "down" when descending a hill, can be accomplished with ease, thus giving the additional safety of the engine as a brake in emergencies.

The headpiece gives the details clearly. The clutch shaft transmits the engine power through the main driving gear to the set of four gears in cluster. These revolve as a unit on bronze bushings on their shaft. The gears on the main shaft revolve freely on steel collars shown alongside of their respective gears. The interior center of each main-shaft gear is given up to an internal, integral gear-ring, Fig. 1. The main shaft is fluted as shown by taking Figs. 1 and 3 in conjunction. Sliding pawls, two long and two short, in right-hand and left-hand pairs, Fig. 4, either rest at ease in the bearing ring Fig. 2, or are at work against the internal gear ring Fig. 1. The mechanism is such that a slight movement of the hand lever is sufficient to cause the pawl to travel longitudinally until it comes opposite the gear ring, when the pressure from the spring in the plunger cage causes it to finish its

THE GEARS—Steel, S.A.E. 3450 Special
Forged, annealed and pickled
Rough turned and external teeth rough shaped
Main shaft gears rough hobbed
Finished to special form in Fellows gear shapers
Internal teeth La Pointe broached
Heat treated in electric furnaces under "Hump" system to approximately 1700 deg. F. and then quenched in oil
Re-heated in salt bath to about 900 deg. F. and quenched in caustic cleaning bath to 'scope 70
Ground internally for concentricity
Inspected and selected and placed in matched sets in trays for delivery to assembly

THE SHAFTS—Steel, S.A.E. 3450 Special
Forged, annealed and pickled
Rough machined-flutes in main shaft hobbed
Heat treated as for gears
Finish ground to 0.0005 in. limits

THE HOUSING—Cast iron, machined

THE PAWLS—Steel, S.A.E. 3450 Special
Forged, annealed and pickled
Machined as per published table
Heat treated as for gears
Finish polished to 0.0005 in.

PRODUCTION RATE—About 150 sets per day

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slide to position, and also to rotate it into position.

This brief introductory description will serve to make clear the fact that there are several unusual problems introduced into manufacture to insure ease and quietness of operation. Four groups of subjects have to be made with great precision, the gears, the main shaft, the clutch shaft and the sliding pawls. The other parts, while of interest, offer no unusual difficulties.

Accuracy begins in the choice of the raw material. After considerable research a steel was found having the approximate formula:

Carbon, 0.47 per cent to 0.53 per cent
Manganese, 0.50 per cent to 0.80 per cent
Chromium, 0.80 per cent to 1.10 per cent

This low tolerance in the carbon is actually adhered

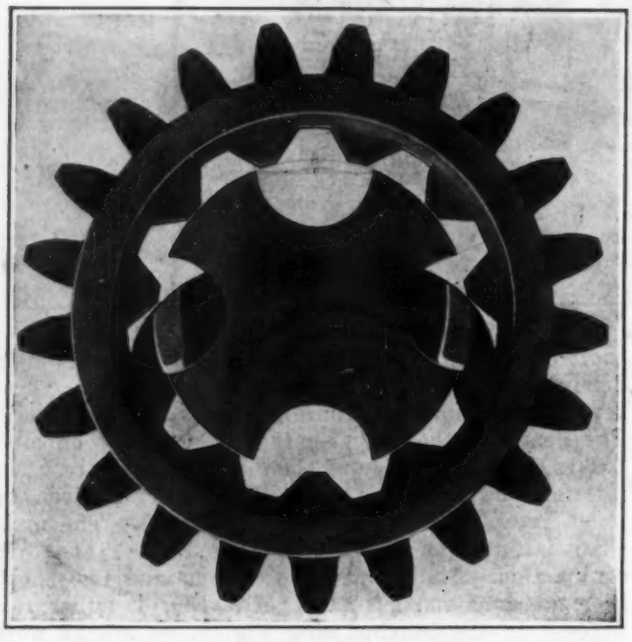

Fig. 1—Main shaft gear

to as it produces a very homogeneous grade of steel whose great virtue is not alone in its strength characteristics but in the great freedom from distortion during heat-treatment operations. All gears, and what is of note, all shafts also, are forgings, the engineers believing that much of their success is due to this fact. The first operation is to have them annealed to remove forging stresses and to obtain good machinability. This is carried out in an oil furnace of conventional type heated to approximately 1,525 deg. F., the forgings being allowed to cool in the furnace itself and finally in air. The Brinell number is then 170 to 207. The next operation is pickling in a muriatic acid bath to get a clean and easily machinable piece of steel.

Roughing of the blank is then proceeded with, and the gear teeth are roughed out in a special shaper as in the case of the cluster gears or in a hobbing machine as in the case of the main shaft gears. All finishing of gears is done on a Fellows gear shaper, and it is worthwhile to note that the cutter used is 4 in. in diameter instead of the more usual 3 inches. It is stated on the authority of Mr. Bouton of the time study department that this increases production and gives just as

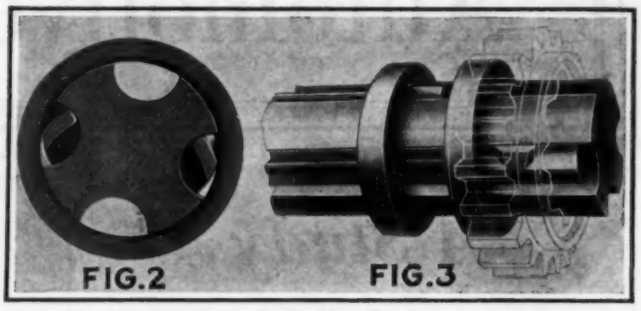

Fig. 2—Bearing ring. Fig. 3—Main shaft assembly

satisfactory results. Another point is that the production of a perfect involute tooth form is not attempted but instead a modified form, such as recommended by Mr. Glen Muffly, formerly of Lees-Bradner, is striven after. Gears change slightly in heat treatment and an expert is able to make allowances and adjust his machined tooth form accordingly. It should be noted that the object in cutting gears is not necessarily the formation of a perfect tooth but rather of a quiet one.

The internal teeth in the main-shaft gears are broached in the usual La Pointe type of machine.

"Hump" Method of Heat Treatment

After roughing, the finish machining (all gears being finished on Fellows gear shapers), the next step, is a most important one. Gears and shafts are placed in a Leeds & Northrup electric furnace of the circular type, Fig. 5, a specific load being assembled in a fixture and lowered into the furnace. Current is turned on and the rise of temperature noted on a recording instrument. The rate of increase of temperature is a straight line inclined at a definite angle to the horizontal time base line, until the critical point of the steel is reached when the heat intake is partly absorbed in creating physical changes in the steel itself, rather than in increasing temperature. At this point the angle of the curve flattens out and, after this internal change is completed, proceeds on its way again. It is allowed to rise for approximately 60 deg. beyond this flattening when the current is turned off, the gears are lifted out of their furnace and quenched in oil. This process is known as the "hump" method and gives almost an individual heat-treatment for each batch of steel.

The gears and shafts are next submerged in a salt bath of large dimensions, Fig. 6. About one ton of a mixture of sodium nitrite and sodium nitrate is used to get the temperature, and to prevent undue changes when new material is introduced. The temperature is held at about 630 deg. F., and after a certain interval

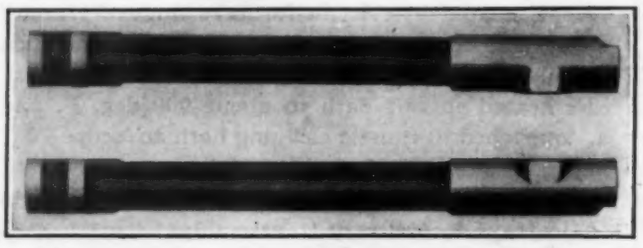

Fig. 4—A pair of sliding pawls

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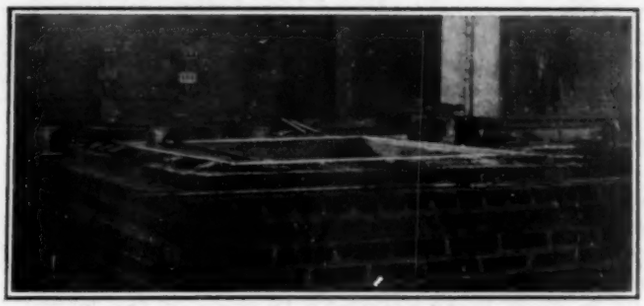


Fig. 6—The salt bath

coarse cutter, Fig 7, of about 1.5 in. pitch. It would seem as if this operation might be too brutal on the shafts but inquiry revealed the fact, as stated by Mr. Frauenthal, chief inspector, that there has been no trouble from this cause and that the shafts leave the hardening bath in large percentage as straight as when they went in. An alternate method suggested is to mill out each diametrically opposite side simultaneously with a milling cutter in a special machine. However, as the hobbing system is more economical and is satisfactory from the viewpoint of ultimate operation, the question answers itself. The shafts are not finished on the hob-

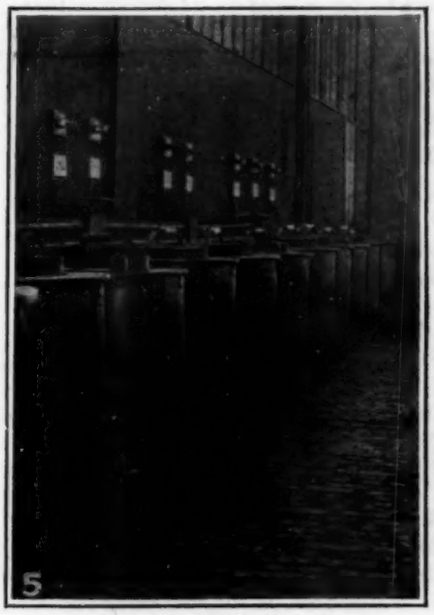


Fig. 5—Electric furnaces. Fig. 7—Hob for fluting main shafts. Fig. 9—Harness for removing shafts from furnaces

the parts are lifted out and plunged into a tank of some special caustic cleaning fluid at boiling temperature to clean off scale and leave clean surfaces. The dimensions of the salt bath are 4 ft. x 4 ft. x 16 in.; the material is cast iron, and the heating is by oil fuel or natural gas as occasion warrants. This process leaves the gears with a scleroscope hardness of 65 to 70.

Note now that there is no burnishing or grinding of the gear after hardening. The only corrective machining is to set the gears true with the pitch line in a special chuck and grind the internal diameter true to avoid eccentricity. The use of the special steel and the care taken in each successive operation is found ample to produce accuracy and quietness in the running gears. One precaution is taken however, and that is to inspect and scrutinize each gear and test it with its running mate on a micrometer-spindle fixture. All gears are matched to run with a small amount of backlash, and when matched they are placed in a special tray and sent to the assembly department. It can be said in passing, that each assembly completed is taken into a sound-proof "silence" room and is there run in under different conditions to check up on the accuracy and quietness. This is in addition to the usual road test.

To return for a short time to the shafts, it is worth while calling attention to the machining of the fluted main shafts. These are actually hobbed, using a very

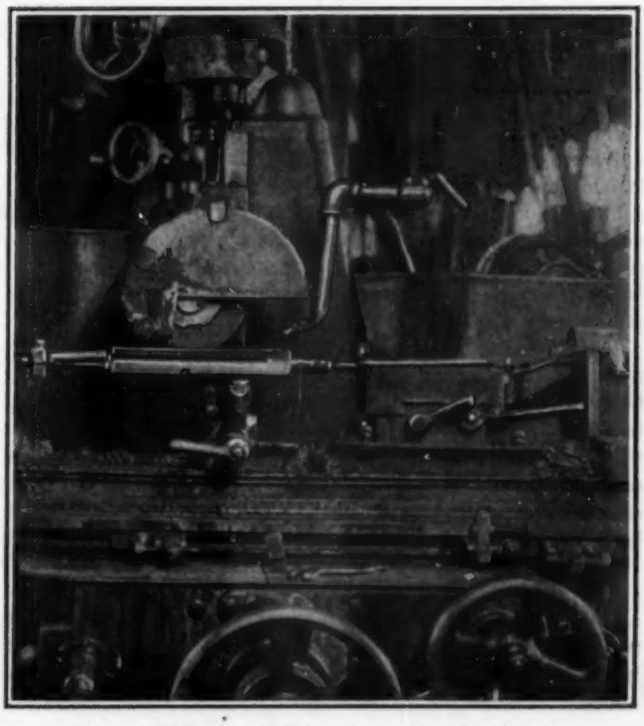


Fig. 8—Form grinding the main shaft flutes

AUTOMOTIVE PRODUCTION

ber but after hardening they are finished form-ground along the flutes as shown in Fig. 8. The diamond truing and forming tool for shaping the wheel is at the extreme right of the machine. The flutes are ground to an accuracy of 0.0005 inch.

The heat-treatment of the main shaft is interesting. The fundamental principles underlying this are the same as in the case of the gears, but there is a special fixture used for holding the shafts in position so that the distortion will be minimized as far as possible, Fig. 9. This holding jig is not the result of accident, but is the final result of careful study. At first the shafts were laid horizontally, resting on the bed of an oil-fired furnace, with the result that they came out all distorted. A change over to electric furnaces was made and the ends were allowed to rest on flat nuts, but even this was not satisfactory and the present method was evolved. A harness holds each shaft vertically and independently. It is stated that less than 20 per cent of the shafts need any straightening process after hardening. Shafts are hardened to a scleroscope figure of 65 to 70, but the main fluted-shaft is drawn down in a lead bath to between 50 and 58 at the rear end. This is done by placing a number of the shafts in a sort of tray in which they hang with their ends exposed. These ends are then dipped in the lead bath to the extent allowed for by the tray for a very definite period of time measured by a stop watch. This draw is an important factor in the ultimate strength and life of the shaft.

The next article will deal with a study of the production of the pawls.

(To be concluded)

Motor Shop Problems

Brakes and Other Bus Topics

By Frank C. Hudson

THE automotive engineer and builder has new problems constantly brought before him. The truck was the logical outcome of the passenger automobile, then came the omnibus, or "bus" of growing usefulness, and now the motor rail-car for branch lines and frequent service in sparsely-settled localities. Each of these developments brought changes in design and construction.

The bus, for example, has entirely different problems in braking from the truck or passenger car. For while both the passenger car and truck must have powerful brakes they are not as a rule, used very frequently, except perhaps in city traffic. The bus driver on the other hand, uses the brake with great regularity, frequently every block in city work. And the brakes have to do a lot of work in stopping the load.

The frequent braking heats the brake drums and some makers of buses are finding that drums that are perfectly satisfactory in truck service, do not stand up in bus work. They find that frequent application heats and distorts the usual type of pressed-steel drum so that it does not give satisfactory service. As a result, the makers have adopted forged-steel brake drums of heavy sections and with ribs on the outside, which assist both in dissipating the heat generated and in stiffening the drums against distortion. The power brake is also being considered for bus service and will probably eventually be used on trucks as well.

Experience in the building of heavy vehicles has also brought about an ever-increasing care in the selection and use of materials for nearly all parts of the truck or bus. Greater care is being taken in the steels used, in the parts being of ample size and properly designed, and in their heat-treatment. In some of the largest plants each piece is tested, either by Brinell or scleroscope, or both, before being passed to assembly. This test is applied to such parts as bolts that hold the springs to the axles, and shackles, as well as to what we may consider the more important parts, as steering knuckles and the like.

Motor Rail Car Development

The motor-driven rail car is not new but its adoption has been very slow, partially owing, perhaps, to the fact that railroads are for the most part, familiar with steam locomotives and unacquainted with internal-combustion motors. But though there have been many steam-driven cars built, they have not been widely adopted. The necessity for a boiler, the space it requires in addition to the fuel, and other drawbacks have put it in the discard. And the internal-combustion motor, which was laughed at by railway men in the early days of the automobile, is beginning to have its inning. It is just coming to bat and time alone will tell whether it will fan out or make a run. So far it hasn't reached first base, but it is on the way and it makes new and interesting work for designers.

Reliability in this connection is almost as important as in airplane work. For while a truck can be pulled to one side of the road and let the traffic go by, it is different on the rails. Of course the motor-driven rail car is protected by block signals, but it isn't a comfortable feeling for the passengers to realize that a hundred-ton locomotive with a string of steel coaches is plowing along a few miles behind and on the same rails. However, as the main use for motor-car units is on branch lines, this is not so serious as it seems and we all know that automobile motors are astonishingly reliable, even under adverse circumstances. It's a new problem, however, particularly on account of remote controls which are necessary in order to operate from either end and where used in trains, as are electrically equipped cars. There's a lot of careful study going on and more of it lies ahead for the ambitious engineer.

This new use of the internal combustion motor brings up the question of transmission very forcibly. Many realize that the present gear set has its drawbacks as full motor power can only be utilized at three definite car speeds. All other speeds are secured by throttling the motor and sacrificing part of its power. Then, too, the shifting of gears in a heavy transmission, especially by remote control, has its difficulties. It is conceivable that these rail car problems may give a new impetus to the development of the hydraulic type of transmission in some form which will prove practicable.

Methods of Machine Tool Design

By A. L. De Leeuw
Consulting Editor, *American Machinist*

Further consideration of feed mechanism for planers — Ratchet and pawl type of feed drive and the design of feed gearing — Devices for feed variation and rapid traverse

A PLANER feed, which is entirely different from those mentioned in the preceding article, depends on the action of ratchet and pawl. The principle is illustrated in Fig. 219. A ratchet wheel is mounted on the end of one of the drive shafts and takes along a reversible pawl mounted on an arm which swings on the same shaft. The movement of the arm is limited by a stop. In this case it is necessary that the pawl be disengaged when or before the arm strikes the stop which is often so arranged that it functions both ways. The reversal of the shaft causes the reversal of the pawl. To accomplish this a friction is mounted on the end of

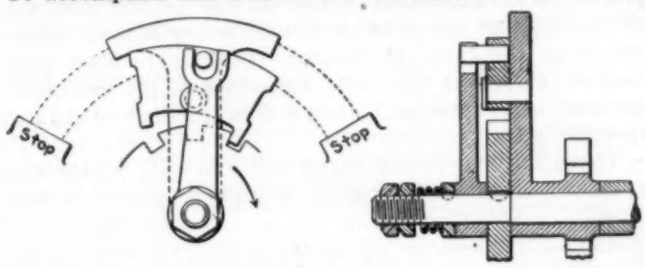


Fig. 219—Ratchet and pawl type of planer feed

the shaft. As the only function of the friction is reversal of the pawl, it can be made very light. The friction device may be merely a tight-fitting sleeve on a shaft, or a pair of collars with a friction surface—say a piece of leather between them. This friction operates any arm which strikes a projecting part of the pawl. The illustration shows one of the many ways in which it can be made to operate the pawl. It also shows how both arm and pawl can be made to strike the stop so that the release of the pawl occurs at the proper moment. An adjustment should be made for the tightness of the friction, so that there shall be no skipping in the action of the device nor shall there be an undue amount of friction, which causes wear.

Still another way of securing feed action at the end of a stroke is to use a one-revolution clutch somewhere on the planer, and to operate the clutch by an impulse given either by the table or by one of the reversing driving shafts. The clutch might be located anywhere on the planer and the necessary connections can be made to trip it either from the dogs or from the tappet lever, or from a special dog mounted somewhere on the table or from a friction device somewhere on one of the shafts. The clutch can be arranged to make one or two or more revolutions or only a fraction of one revolution. The trip mechanism may be arranged so that it may be operated mechanically or by hand. When operated by hand it is even possible to construct it so as to allow as many revolutions as may be desired in order to obtain an intermittent feed or a quick traverse.

To study somewhat more closely the action of such a device, we must first see what an intermittent feed does to the members which are to be moved. These members are the saddles and tool slides on the cross rail and also the side heads and their tool slides. As a rule, it is desirable to be able to adjust the amount of feed for each of the elements separately. For instance, we may wish to have a fairly coarse feed for the right-hand saddle and, at the same time, a rather fine feed for the left-hand tool slide. Formerly, one single shaft or rack was used to give the feed to both saddles and tool slides on the cross-rail and, if side heads were used, it was customary to make the feed in amount independent of the rail heads. The manner in which this was done was the following: *A* in Fig. 220 is the slotted crank which gives motion to a rack operating the cross-rail feed. An arm *B* of this slotted crank operated a similar slotted crank which in some way was connected to the side heads. The crank *A* oscillated, as was described before, and by its connections would give a fixed amount of oscillation to the crank *C*. As both cranks *A* and *C* were slotted, it was possible to operate the side heads and rail heads independently of each other, at least as to the amount of feed.

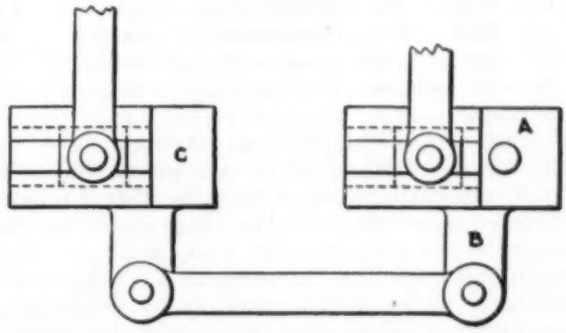


Fig. 220—Old device for feeding side heads from cross rail feed

Nowadays the slotted cranks are generally placed on the cross rails for the rail heads and on the housings for the side-heads, and there is a separate slotted crank for each of these heads. The impulse or drive still comes from such a feed box as was described before, or possibly from some other type, as will be described later on. This arrangement makes it possible not only to have different amounts of feed for the different heads, but also to have each head run in the desired direction. If, in addition, there should be a constant

For the author's forthcoming book. All rights reserved. This is the fourteenth article of the series. The thirteenth was concluded on page 320, Vol. 61, No. 8.

speed shaft which made connection in some way with the screws or rods feeding the heads or tool slides, then it would be possible to shift over from quick traverse to feed or vice versa and to do this independently for each head. For instance, it would be possible to keep on feeding with the left-hand rail head while traversing the right-hand head.

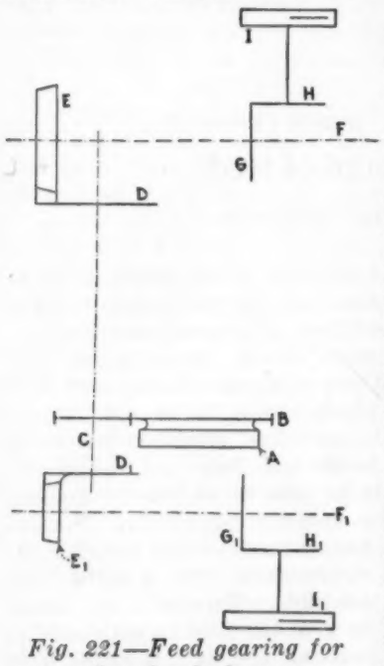


Fig. 221—Feed gearing for four-head planer

The most common way of accomplishing this is to do away with the slotted crank on the feed box and substitute for it a gear, ordinarily a bevel gear segment, which drives another gear keyed to a shaft. This shaft passes behind the end of the cross rail and connects with the feed screw and feed rod. To handle four heads with independent feeds, we would have an arrangement such as is diagrammatically illustrated in Fig. 221. Here *A* represents the feed box, which, through a gear *B*, drives another gear *C* mounted on a shaft going across the planer. Mounted at the other end of the shaft is a bevel segment *D*, driving a bevel pinion *E*, which is mounted on the shaft *F*. There is also a bevel segment D_1 mounted on the hub of *C*, which drives a pinion E_1 on shaft F_1. Either by gearing or by lever connections a second shaft is driven on each side of the planer for the side heads.

On each of the two shafts *F* and F_1 a bevel pinion *G* is mounted, driving a gear *H*, on the shaft of which is keyed a slotted crank *I*. This mechanism *F-G-H-I* is mounted behind the cross-rail and sometimes behind the side head. The arrangement of gearing or connections may be varied in an unlimited number of ways and should depend on the other features of construction of the planer.

In practically all planer-feed constructions of this kind a slotted crank is used to vary the amount of the feed. A connection reaching from the slotted crank to a general segment oscillates the latter and from there on the motion is given to a slip gear on the end of the screw or feed rod. Fig. 222 shows this arrangement in diagram. *A* is the slotted crank, *B* the connection, *C* the gear segment, *D* the idler from which the slip gears *E* and *F* are driven. As *C* oscillates it will give an oscillating motion also to the gears *E* or *F*. However, as the pitch diameter of *C* is much greater than that of *E* or *F*, it is very well possible that each of these latter gears may oscillate through more than an entire revolution. Whatever the amount of movement of *E* or *F* may be, they must return again through the same angle, so that if they were directly connected to rod or screw they would advance the saddle or tool slide, and then cause it to retreat again. For this reason the slip gears *E* and *F* are constructed as ratchet gears, and the ratchet can be set in such a way that either the left- or right-hand rotation can be made effective.

If now we should introduce a quick-traverse shaft somewhere in this mechanism, we would have to be careful to make it entirely independent of the feed mechanism; in other words, construct it so that the two motions cannot take place at the same time. We see further that we must connect it after the gear *C* is passed, because this gear cannot make an entire revolution. The natural place, then, to attach this quick-traverse mechanism is at the point where the idler *D* is located. Fig. 223 shows how this may be accomplished. *E* is the slip gear which is driven from gear *D*. This gear is keyed to a shaft on which the gears *G* and *H* are located. Both of these gears are clutch gears and can drive the shaft by means of clutch *I*. The gear *G* is driven from the feed mechanism, whereas the gear *H* is driven from the quick-traverse shaft *K* through gear *L*.

There is a certain advantage to be gained by using a one-revolution clutch instead of a friction-feed box. The latter device does not begin to work until the planer reverses, so that all of the time consumed for the feed comes on one end of the stroke. If, for instance, 6 in. of table travel should be required for the duration of the feed movement and we use a friction-feed box, then the cut cannot start until after the planer has traveled 6 in. On the other hand, if we should have a one-revolution clutch which is not started by the reversal of the table or the gearing, but by a dog located somewhere on the table, it would be possible to start this feed 3 in. before the table has reached its points of reversal and continue it during 3 in. of the travel in a new direction.

Though the previous paragraph correctly states the principle involved, it paints a picture which is not

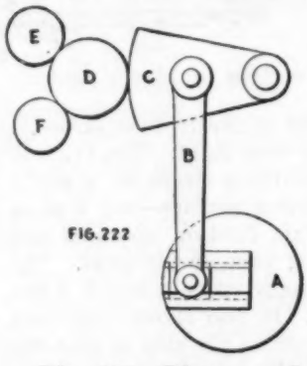


FIG. 222

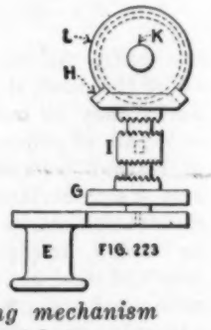


FIG. 223

Fig. 222—Diagram of feed varying mechanism
Fig. 223—Diagram showing how quick traverse mechanism is introduced

entirely true. A planer stroke has not the same speed in both direction. To see how this affects the condition of travel required for feed, let us imagine that the planer table runs 30 ft. per minute on the cutting stroke and 90 ft. per minute on the return stroke; or 6 in. per second on the cutting and 18 in. per second on the return stroke. Let us further suppose that if we had had a friction-feed box, 6 in. of cutting stroke would be required for the feed. Of course, in that case 6 in. of stroke would also have been required if the feed had been taken at the beginning of the return stroke, because the feed box is attached to one of the reversing shafts and any of these shafts will run at a higher speed in one direction than in the other.

Six inches of cutting stroke are made in one second. Let us now arrange our one-revolution clutch so that it makes one complete turn in one second; and let us

divide this time so that an equal number of inches is consumed on both strokes. Let this number of inches be x; then $\frac{x}{6}$ seconds is consumed on the cutting stroke and $\frac{x}{18}$ seconds on the return stroke; and the sum of these two must be one second; so that

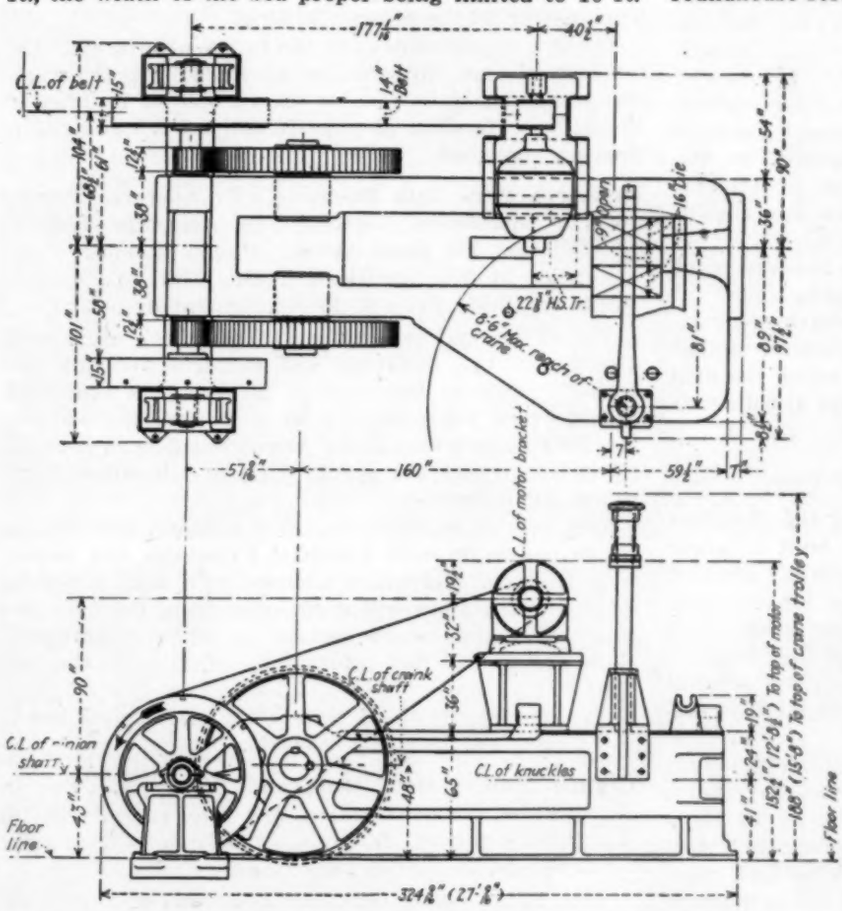
$$\frac{x}{6} + \frac{x}{18} = 1$$
$$4x = 18$$
$$x = 4\tfrac{1}{2}$$

We see, then, that we have saved part of the stroke required for the feed, but not as much as we had expected.

Large Ajax Forging Machine Being Built in Cleveland

The Ajax Manufacturing Co. is now building in its plant at Cleveland, Ohio, what is thought to be the largest upsetting forging machine yet constructed. The machine is not completed but the accompanying dimensioned views will give some idea of the size of the machine. The computed weight of the whole machine is 310,000 pounds.

The over-all length of the assembled machine is 27 ft., the width of the bed proper being limited to 10 ft.



Top and side views of large Ajax machine

5 in. by shipping restrictions. The steel bed casting alone weighs 165,000 lb. and the flywheels, of which there are two, are 7 ft. in diameter and 15 in. across the face. They weigh 10,000 lb. each.

The machine will accommodate dies 16 in. thick, 36 in. long and 36 in. high, the weight of such dies being approximately 5,700 lb. each. Power for driving will be furnished by a 100-hp. motor.

This machine has been especially designed for the National Tube Co. and will be used in its plant in Gary, Ind., for upsetting the ends of seamless steel tubing.

The Roundhouse Foreman's Job —Discussion

BY G. CHARLES HOEY

The article under the title given above by R. W. Hamer, on page 684, Vol. 60, of the *American Machinist*, causes several questions in the mind of one acquainted with the duties of a roundhouse foreman. I admit that a roundhouse foreman has many griefs and a variety of problems to handle, but by proper organization of his available forces, he can lessen his difficulties greatly.

If, as Mr. Hamer says, the report quoted was a representative work-report, I would be inclined to make several comments.

The engineer in question had evidently had an extremely hard or disagreeable trip and was feeling grouchy. Or he was one of those overcautious souls who report things that need no repair but want the roundhouse force to give them plenty of service. After a little experience a roundhouse foreman learns to know this type of engineer and to ignore about two thirds of his wails.

The power on that particular road could not have been in very good condition. Many things quoted by Mr. Hamer should run from shopping to shopping without replacement, as for instance, generators, chafing casting between engine and tender, end sill on front end, coil springs and spring hangers.

Proper organization of available roundhouse forces would reduce the difficulties of the job. The engineer has made out quite a report on the condition of his air equipment. The air brake repairman, foreman, or inspector on the job could easily handle these problems, in fact, it is quite probable that an inspection and test of the air equipment would show that many things were reported that require no work. In one place the engineer reports, "examine and repair air pumps," later he says, "test air pumps; not making enough air," and still later he says, "stop leaks in air pump at main reservoir." It would seem that the proper step here would be for the inspector to first inspect that leak at the main reservoir to see if it could be the cause of the pumps "not making enough air."

I agree with Mr. Hamer that a roundhouse foreman has plenty to keep his mind occupied, but if he will do a little careful planning he can greatly reduce his worries and still keep his power in safe condition.

Famous Machinists of History

By H. H. Manchester

John Wilkinson (1728-1808)

John Wilkinson was born at Clifton, England, in 1728, where his father Isaac was overseer in an iron furnace.

In 1738 the father took out a patent for a box-iron. This was a flatiron used by laundresses, the name arising from the fact that it was hollow so that it could be filled with live charcoal in order to be kept hot.

The father moved to Blackbarrow, near Furness, and started a small factory for these irons. John worked in the shop, and became an adept in all the processes used in the construction of the box-iron.

At the age of twenty John started work in an iron mill, and a few years later built a small furnace for himself in Staffordshire. Here he experimented in the use of mineral coal in the place of charcoal, which was then considered the only practical fuel.

In the meantime the father moved his box-iron plant to Bersham, where in 1756 he was joined by John.

In addition to using mineral coal, John made various other improvements. The most important, at that time, was the new method of boring by which the drill was placed on a shaft which was held rigid at both ends of the cylinder that was being bored.

His Boring Machine Proves Popular

John was the manager and owner of the Bersham works from 1761, and soon afterwards built a larger plant at Brosley. His improved borer got the contract for boring government cannon, and he became very prosperous. He bored the first successful cylinders for Watt, and took the first engine built by Watt to blow his furnaces. He also continued to use mineral coal, and by his progressiveness outstripped his competitors.

In 1779 he made the structural iron for the first iron bridge in England, which was placed over the Severn. Eight years later he built an iron barge to carry castings, and in 1790 disclosed still further inventive ability in an improved patent for drawing lead pipe. On his 500-acre farm he employed a threshing machine worked by steam. In 1794 his brother William introduced his smelting by mineral coal and his boring system into France.

John died in Bradley, in 1808, a good type of a hard-headed, but highly progressive 18th-century manufacturer.

Book Reviews

Aircraft Year Book 1924. 328 pages 6x9 in. Published by the Aeronautical Chamber of Commerce, New York

This volume becomes more interesting each year and no one can fail to be impressed with the steady growth of aviation, even though its progress in this country is much slower than it should be. It is interesting to note that commercial aircraft in this country flew over 3,000,000 miles, carried nearly 81,000 passengers and transported over 200,000 lb. of freight and express matter. Airplanes are also being used for forest fire patrol, mapping cities, reclaiming waste lands, destroying crop pests and for advertising and publicity.

The data and illustrations contained in this volume are of particular interest to all who realize even faintly what progress we have made. The pictures showing the dusting of cotton fields with calcium arsenate, which effectually eliminates the boll weevil, impress the reader with the great possibilities of the plane for rapidly and effectually wiping out the mosquito and many other pests.

Full information is given of the round-the-world flight, showing the object, the personnel, the equipment and the painstaking preparation which has made it such a success up to the present writing.

There is no question as to the future of aircraft. Its development can, however, be hastened by a thorough understanding of its present status, and all its friends should be as familiar as possible with what has already been accomplished.

Making Letters Talk Business. By Sherman Perry, Correspondence Adviser, The American Rolling Mill Co. 184 pages, 6x9 in. Bound in cloth. Published by The American Rolling Mill Co., Middletown, Ohio. Price $1.25 (Accompanying order).

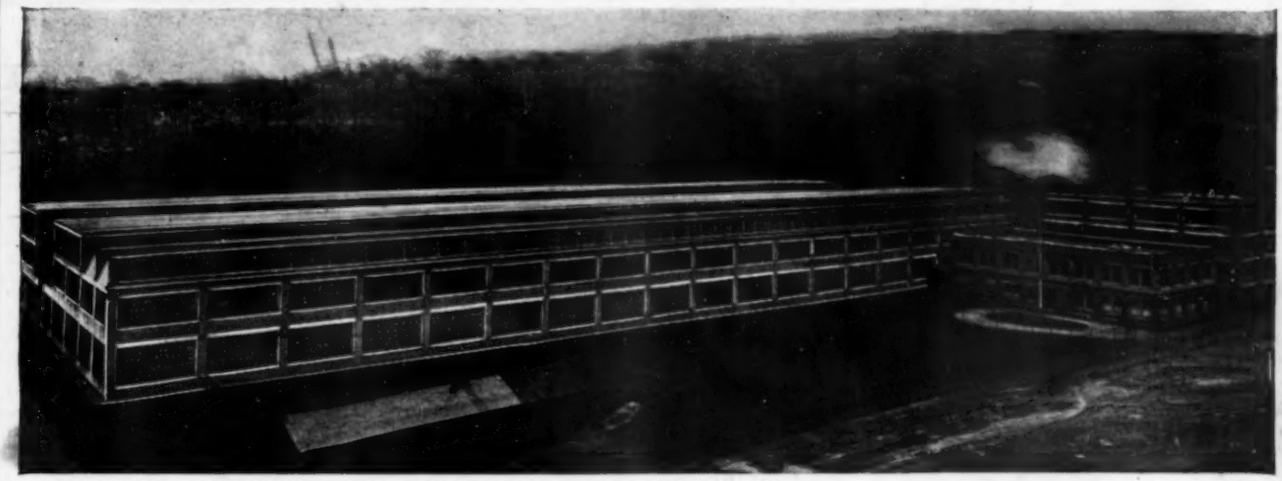
The advice and information in this book are aimed directly at the dictators and stenographers of the author's company but most of the thoughts expressed should prove instructive to letter writers everywhere. Mr. Perry uses letters about Armco products as illustrations, but in such a way that they are illuminating to people not interested in iron.

The book is divided into three sections, the first of which has to do with Essential Principles, the second with Essential Mechanics, and the third with Essential English. Dictators will profit most from the first section, while the second section is for stenographers. Both groups will find information of value in the last section.

Typographically the book is not a masterpiece but it is different and decidedly readable.

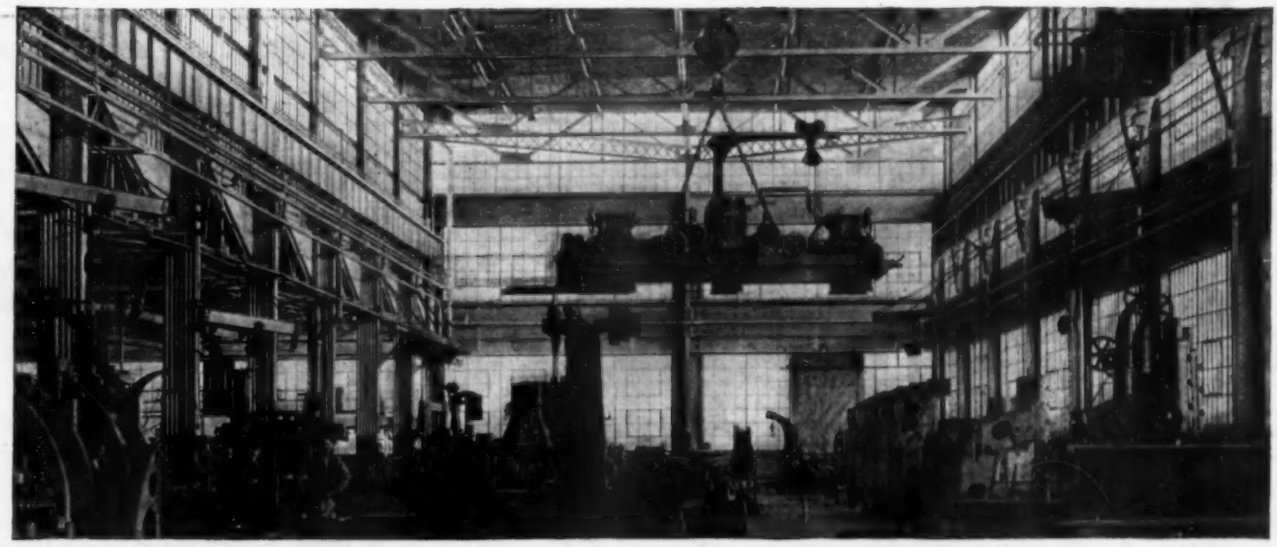
Crain's Market Data Book and Directory. Fourth Edition. Five hundred and five pages, 6x9 in. Published by G. D. Crain, Jr., 537 S. Dearborn St., Chicago, Ill. Price $5.

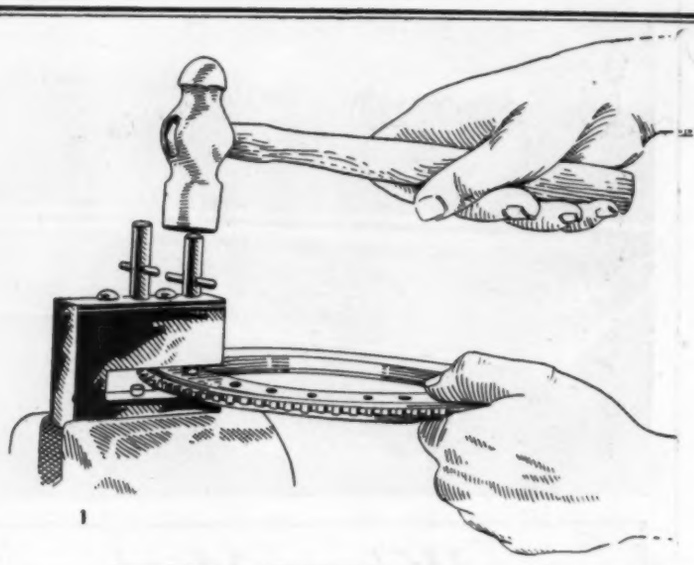
This is the yearly book of class, trade and technical publications with data on the various markets of the world showing production figures, sales and sales possibilities and other interesting statistics. Accompanying each classification is a list of publications that either cover or touch the industry described and upon which figures are available.



Where Machine Tools Are Made

Manning, Maxwell & Moore, Inc.
Putnam Machine Works
Fitchburg, Mass.
Original company (J. & S. W. Putnam) founded 1836





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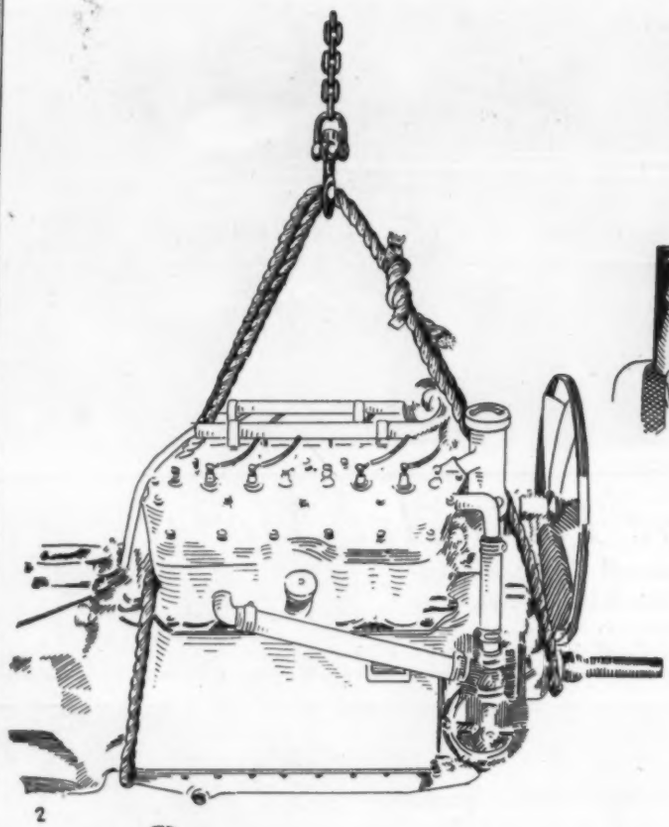

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Handling Repairs o

Fig. 1—Device for relining clutch disk

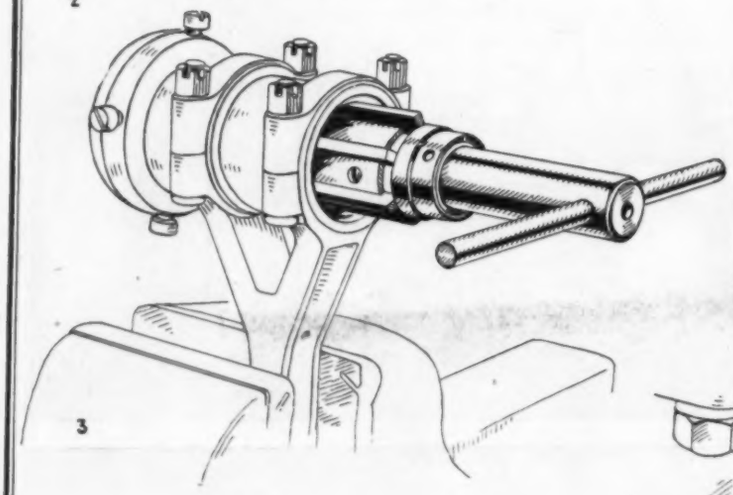
Fig. 2—The way to sling the motor

Fig. 3—Reaming connecting-rod bearing

Fig. 4—Removing spring-eye bushing

Fig. 5—Removing shackle bushing from frame

Fig. 6—Testing cylinder bore



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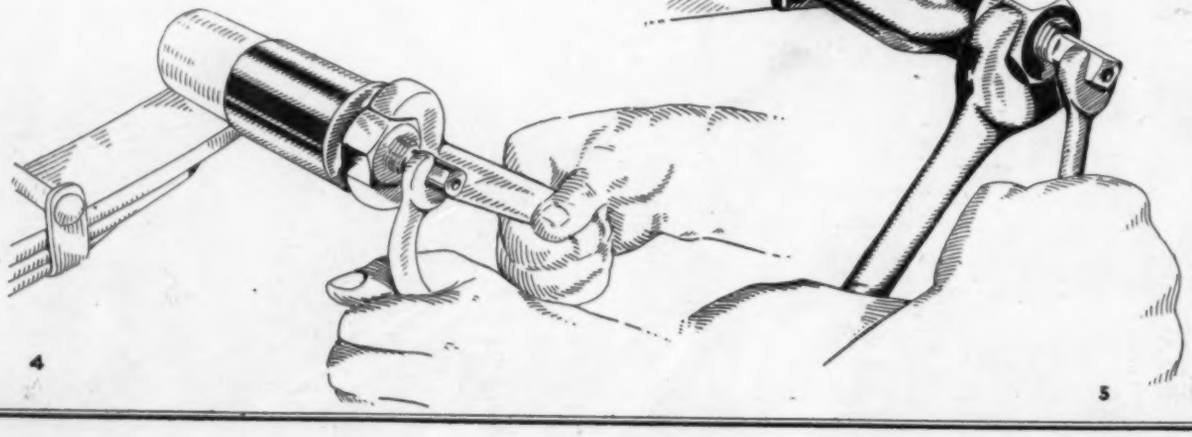

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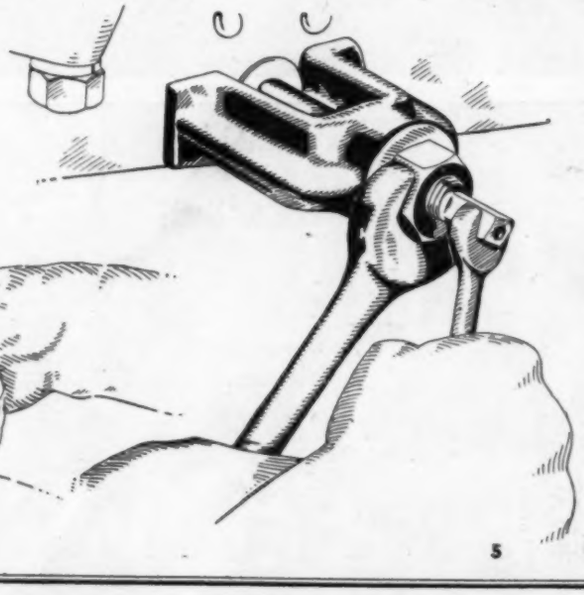

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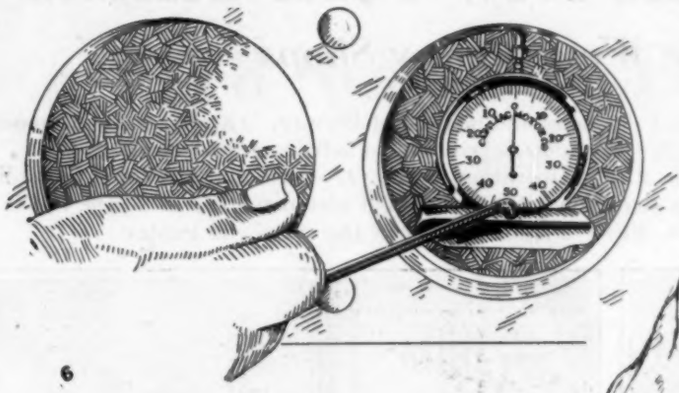

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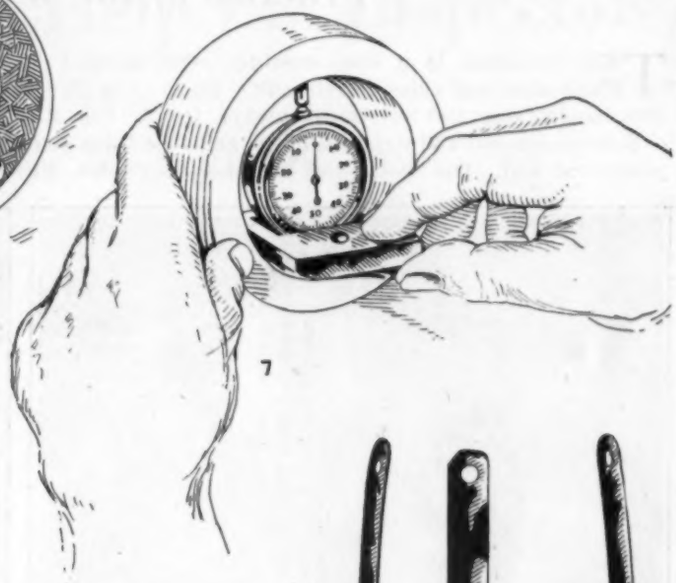

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on Cadillac Cars

Fig. 7—Setting cylinder gage by standard gage

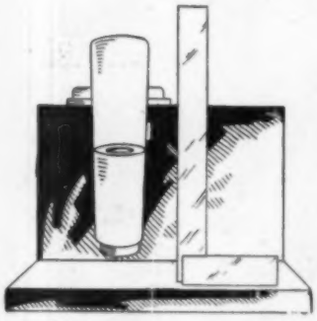
Fig. 8—Testing squareness of front axle

Fig. 9—Removing piston rings from grooves

Fig. 10—Angle of spindle hole is 5 deg.— or 1 in. in 12 1/16 inches

Fig. 11—Testing alignment of connecting rod

Fig. 12—Removing roller-bearing mounting



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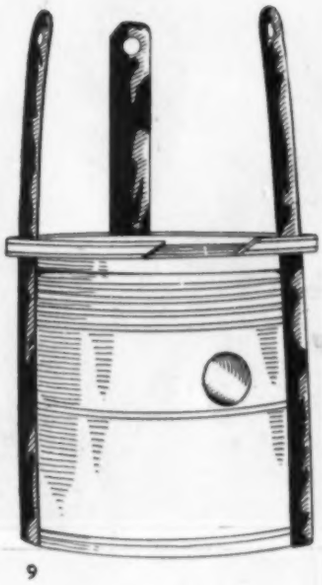

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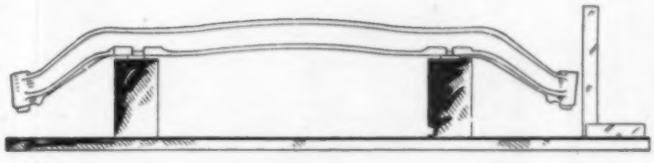

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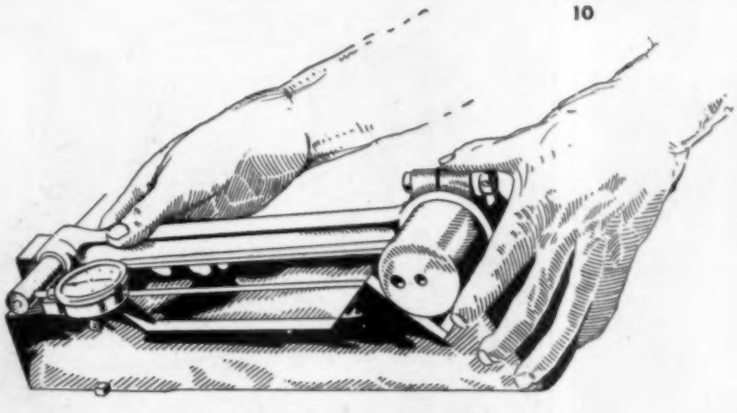

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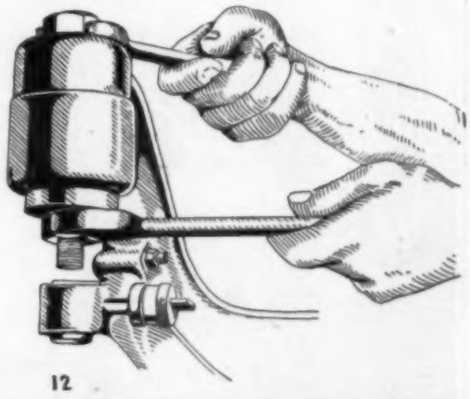


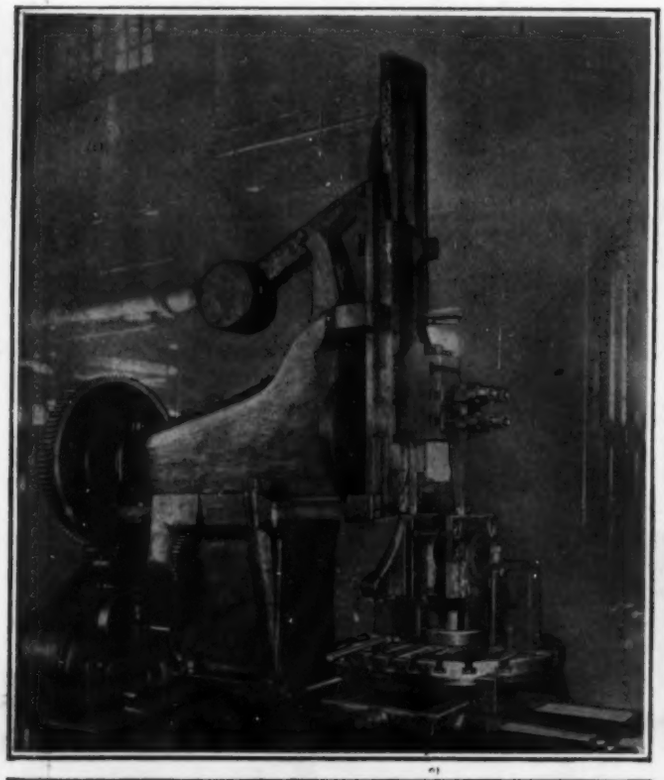
12

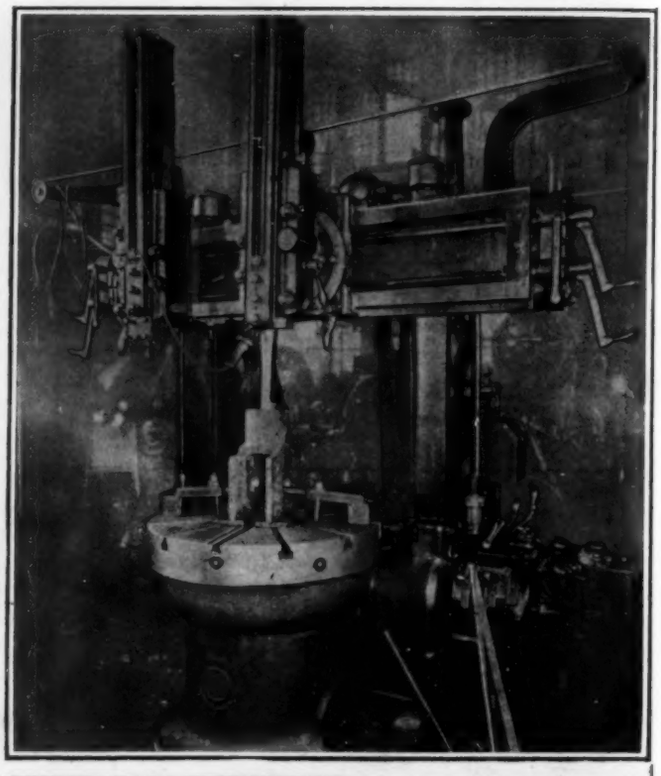
Crossheads on the New York Central

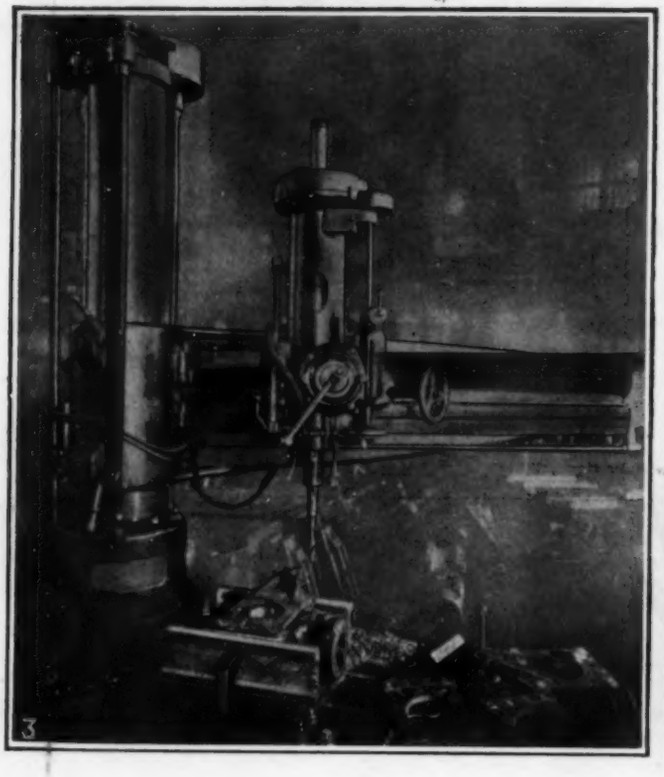
Practice of the West Albany Shops

THE crosshead is a steel casting. Operation 1—Plane slots and sides for shoe fit. Op. 2 *(Fig. 1)*—Slot inside faces and wristpin keyway. Op. 3 *(Fig. 2)*—Bore piston-rod and wristpin holes, and face sides and piston-rod end. Op. 4—Layout for shoe-bolt holes, oil holes and piston-rod keyway. (Keyways are at opposite angles in right- and left-hand crossheads.)

Operation 5 *(Fig. 3)*—Drill bolt holes and union link-pin hole. Op. 6—Cut piston-rod key slot. Op. 7 *(Fig. 4)*—Plane shoes to fit the crosshead guides.







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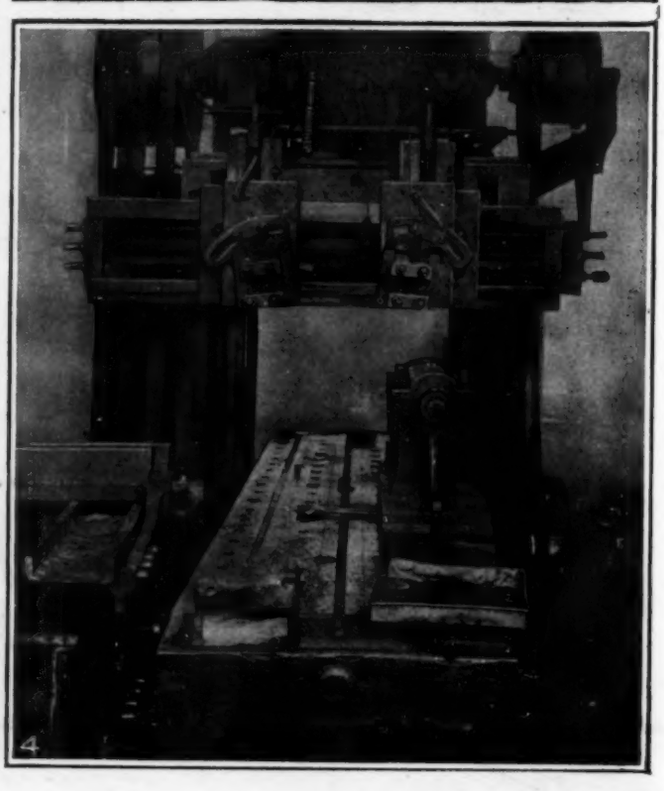


4

A Card System to Help the Inspector

By K. H. Crumrine

Two conditions to be met in manufacture—Many essential details not specified on drawings—When and where the drawings may be disregarded safely

IN ORDER to secure satisfactory results in the manufacture of any machine, there are two principal requirements to which every part must conform. One is that each part must be so made that it can be assembled readily, and with a minimum of labor and fitting with its complementary parts, and the other and more important one is that it shall perform its individual functions fully and properly.

As a guide to the fulfillment of the first requirement, the drawing usually furnishes sufficient information—showing fully all dimensions, tolerances, etc.—but it is not uncommon for the drawing to lack many of the specifications necessary to make the part perform the duty for which it is intended, leaving the control of these essentials to the knowledge and the more or less trustworthy memory of the inspectors. In other words, the inspectors must know what are the essential features, and they must not fail to make the tests necessary to determine that the requirements have been met, regardless of whether the drawing does or does not carry notations concerning them.

It may be assumed that a good inspector possesses such knowledge and that he will not fail to make the tests, but in actual practice it is not infrequently the case that parts quite in accordance with the specifications of the drawing are not at all satisfactory when incorporated in the finished machine. Too often the defect is not discovered at the time of the assembly and results in inefficient operation of the machine at a later period, or causes it to become old before its time.

Examples of such defects are: surfaces not parallel or square; parts not properly hardened or tempered; threads out of alignment; keyways not parallel or not centrally located; holes not drilled or tapped square with the body of the piece, and many other details of a like nature. These are points not usually indicated on drawings—in fact they would seem almost ridiculous if so indicated—yet the workmen and inspectors are expected to know the requirements in this respect and take care of them. If they are overlooked they are bound to cause vexatious delay on the assembly floor or trouble in the finished product.

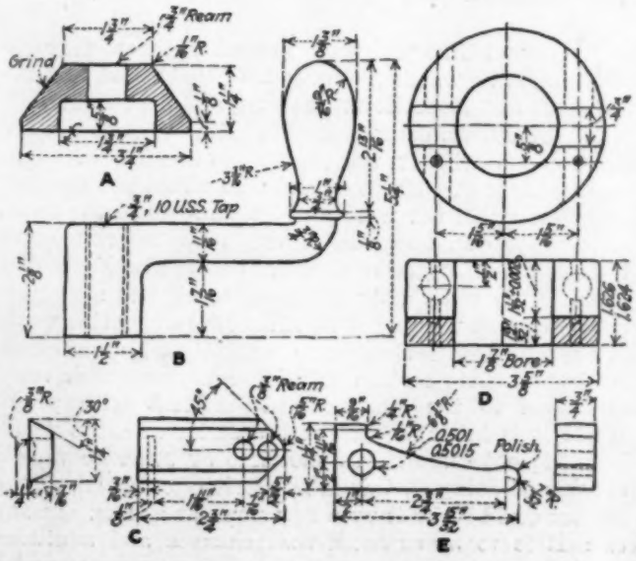


Fig. 1—Where extra tolerances might be allowed

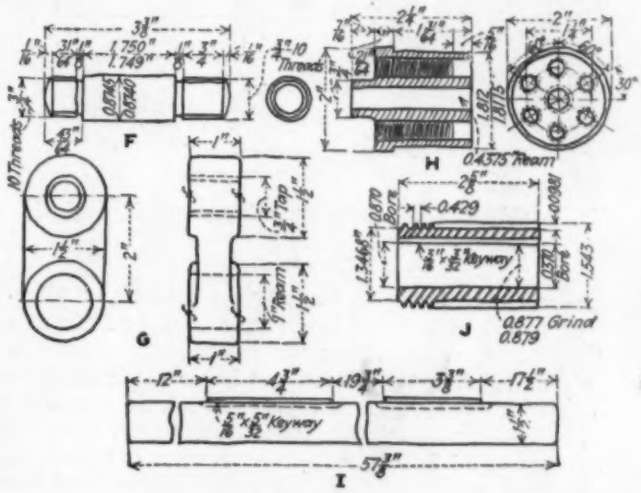


Fig. 2—Threaded holes must be accurately square with surfaces

On the other hand, many parts may vary widely from any specifications that would be tolerated on a drawing by the engineering department, and still serve their purpose perfectly, and if the inspector were to adhere strictly to the limitations imposed by the drawing, he might be compelled to throw out much perfectly good material.

The writer has long held the opinion that it would be an excellent plan to have at the inspector's bench a set of cards, each card to be numbered in accordance with a certain part the inspector is required to handle, and carry notations with respect to that part not to be found upon the drawings, as well as tolerances that would not be permissible on the drawings themselves but which would often prevent the scrapping of a perfectly serviceable part.

In addition to such notations, the cards might well

bear instructions for making tests that may be a trifle out of the ordinary, and, if it seemed desirable to go so far, to specify all of the devices and equipment to be used in making the tests—excepting, perhaps, the ordinary measuring instruments. Important inspections are sometimes omitted because the inspector does not readily think of a suitable way to make them.

The part shown at *A* in Fig. 1, has for the guidance of the workman certain dimensions, none of which, as a matter of fact, need be strictly observed. Fractional

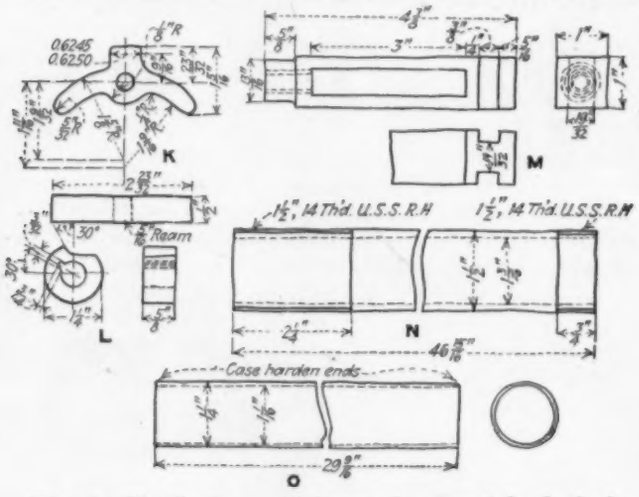


Fig. 3—Hardening and tempering must be looked after carefully

dimensions usually have, by common consent, a tolerance of 0.005 or 0.010 in., either over or under. In this case, however, $\frac{1}{16}$ in. either way would not affect the usefulness of the part. Even the hole, which shows a tolerance of only 0.001 in., plus or minus, could be $\frac{1}{32}$ in. large without detriment. It is, however, essential that the top and bottom surfaces of this piece be parallel one with the other. The inspection card for this piece might, therefore, read as follows: "Top and bottom surfaces must be parallel. The $\frac{3}{4}$-in. hole may be a trifle large but not small. Use indicator No." (insert No. of instrument.)

The part shown at *B* has many dimensions of greater or lesser importance, including the tapped hole, but it is particularly important that the latter be square with the face, and this is a point that might easily be overlooked by the inspector on a piece so seemingly unimportant. On parts *C*, *D* and *E* it is essential that the holes be square with their relative surfaces. This is particularly important on part *C*, and on part *D* is particularly difficult to attain. Other features of the parts attract the attention of the inspector—such as the size of the large hole in part *D*, the dovetail fit on part *C* and the shape of part *E*—but the squareness of the small holes mentioned might be overlooked.

Accuracy Required

On the parts *F*, *G* and *H*, Fig. 2, the threads must be true and the tapped holes square and parallel. No mention is made of this fact on the drawing, yet such parts are often tested only for size and pitch of thread and passed along. It is plain, however, that the threads and tapped holes might be so badly out of line as to render the part unsatisfactory, to say the least.

Parts *I* and *J* have keyways that must be parallel with the hole and shaft. Broached keyways are fairly safe as regards this point, but those made by other methods must be watched closely. Keyways out of line cause much unnecessary work in assembling and usually present but a one-point bearing when completed.

Inspection for hardness and proper temper is, perhaps, more often neglected than any other single feature. Parts *K* and *L*, Fig. 3, must be casehardened, yet a single point on part *L* and four small surfaces on part *K* are all that need be really hard. But in addition to being hard at the required places, the case in these places must be sufficiently deep to provide against a reasonable amount of wear, which makes it necessary to break and examine a few specimens from each hardening. The failure of part *K* in use involves quite an expensive repair, and preventing this will pay a handsome dividend on the cost of proper inspection, therefore the requisite conditions above mentioned should be clearly specified on the inspector's card.

Amount of Allowable Error

On part *M*, the two slots must be directly opposite and parallel, yet by taking advantage of the 0.010-in. allowance for fractional dimensions, they might be 0.020 in. out of line and still be passable according to the drawing. On part *N* the two threads must be true with each other and on part *O*, the two ends must be parallel. On part *P*, Fig. 4, the face must be true and square with the hole, and on part *Q*, the dovetail must be square with the tongue. All of these are vitally essential points, fully as much so as the carefully indicated dimensions—yet all are left to the judgment of the men who make the parts and the inspectors who examine them. Truly enough, skilled men and competent inspectors will see that the parts are made properly, but men of less experience are likely to pass over some of the most essential details.

Inspection cards as described above would point out

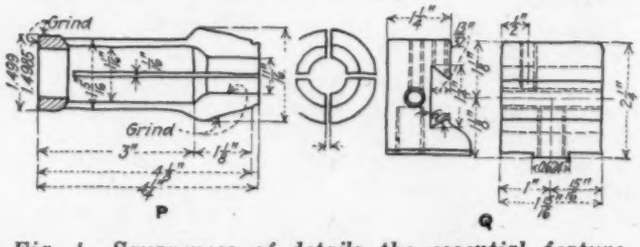


Fig. 4—Squareness of details the essential feature

to the most inexperienced inspector those features which must be watched closely, and would tend to make the results of inspection more sure and dependable. It would, of course, be necessary to have such cards made out by one who is thoroughly conversant with the requirements of each part, and who would use the best of judgment in the wording of them. Once the cards were made out, however, it would be necessary only to have as an inspector a reliable man who knew how to make the tests, and the more experienced man need not be tied up with what is, after all, but routine work.

The one who makes out a quantity of such cards, might well note certain valuable equipment that could be added to the inspection department with profit. While it is intended that such a series of cards would be made out complete at one time by someone who is capable of doing it, this is not strictly essential, as the system could be built up a few cards at a time. In any case it is to be expected that changes and additions would be made from time to time, as is customary with drawings.

Ideas from Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for

Graduating in a Turret Lathe

By Herbert F. Crawford

The illustrations show a method of graduating thimbles, devised by the Atwater-Kent Co. as a wartime necessity for some of its work at that time. The machine was developed from a small turret lathe by mounting a cross-shaft at the foot of the lathe bed, as at *A*, Fig. 1, for driving the turret slide, the tool *B*, being held in the turret. The indexing mechanism consisted of the double index-plate *C*, mounted on the lathe spindle. The plate was moved by pawls at the back, operated by the turret slide on its forward stroke.

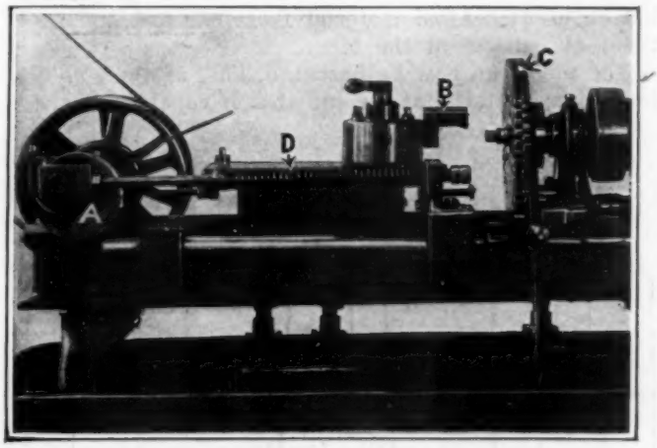


Fig. 1—Turret lathe rigged for graduation

The turret slide was not positively controlled by the connecting rod except on the return stroke, the power for the forward or cutting stroke being delivered through the long coil spring *D*. The length of graduation mark of each stroke is controlled by the stop *E* Fig. 2, and the depressions *F* in the face of the index plate. These depressions are five graduations apart, every alternate one being deep or shallow.

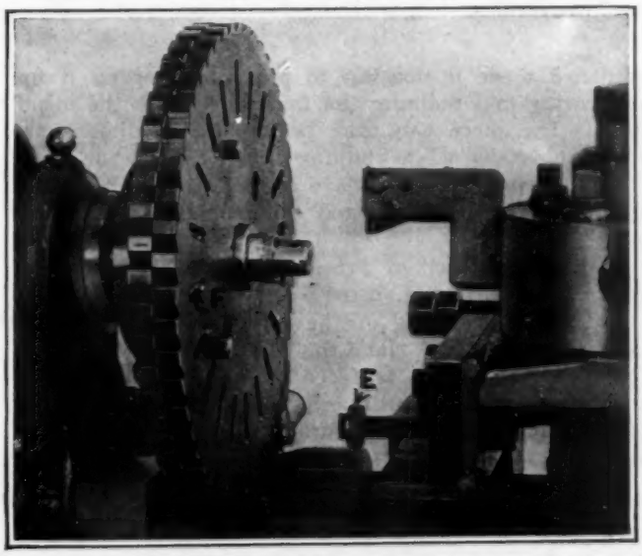


Fig. 2—A detail of the indexing device and tool

In this way the stop *E* secures three lengths of lines. When the flattened head strikes the index plate between the depressions, the tool can only cut a short line. At every fifth stroke the head enters a shallow depression and produces the medium length of line and at every tenth stroke, the deep depression allows the stop to enter to the shoulder and the cutting tool, to make the long line. The difference in stroke is taken up by the long spring *D*, Fig 1, shown beside the turret slide.

A Set of Tools for Bending Tubes—Discussion

By Cyril B. Clark

Referring to the article under the title given above by L. R. Heston and published on page 941, Vol. 60, of the *American Machinist*, the method he describes is well known and is applicable under certain conditions and within certain limitations; the first of which is exactness of results required; and, second, the relation of tube diameter, wall thickness and radius of bend.

The tube to which I referred in my previous article, appearing on page 518, was of 0.042-in. wall and the bend was of $1\frac{3}{4}$-in. inside radius. I have a sample of the compound bend before me and to the eye there is no distortion apparent. With the calipers a slight difference in the two diameters may be found, which might have been almost entirely eliminated by correct adjustment of the mandrel.

No hard and fast method can be set down for all cases. Each job must be considered according to its individual requirements, and the best way to do it is by the method that will most cheaply and quickly fulfill the requirements. I have seen a semi-circular bend in 2-in. diameter tubing, made in the manner described by Mr. Heston, result in a difference of $\frac{1}{32}$ in. between the two diameters, and yet be considered quite acceptable for the purpose for which it was to be used. The tube coming from a die made as he describes will not be a true circle in section, but will look much the same as the moon does about twenty-four hours before or after it is full.

Mr. Heston states that it is important that the groove in the die be made a tight fit for the tube, and then he says that it is to be used without lubricant. I am curious to know how many passes can be made with it before it becomes loose.

I have made many dies in which the same principle of construction—or perhaps I had better say action—were involved, and they produced hundreds of thousands

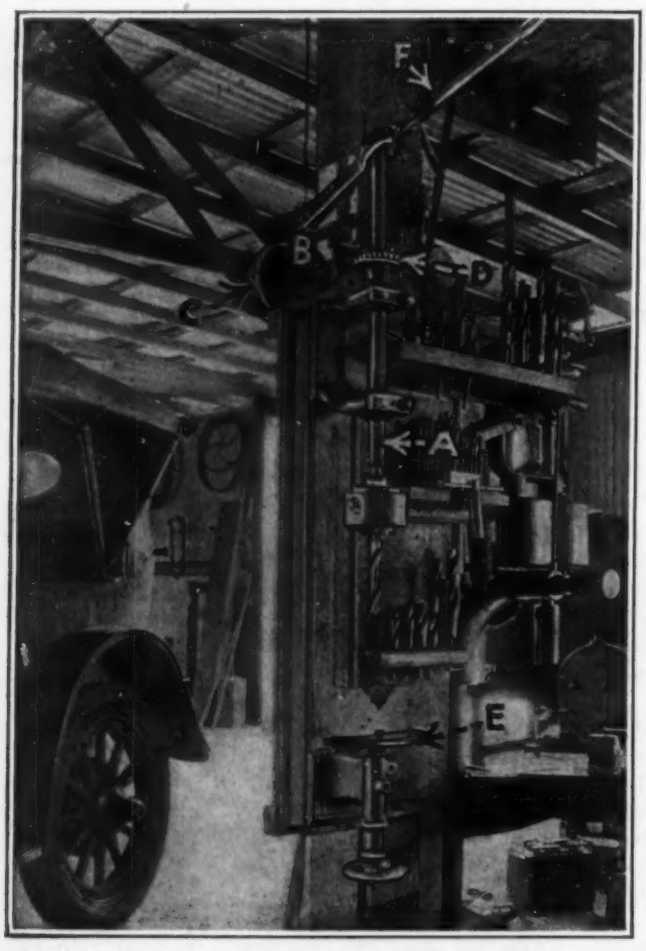
of Ford exhaust-tubes. The dies were made in halves so that when worn, they could be replaned and the groove closed up.

Utilizing an Old Bench Lathe

By Charles F. Henry

A large sized bench lathe which has seen better days was found recently in the shop of the Deane Machine Co., Bradentown, Fla., doing duty as a vertical drilling machine, as shown in the accompanying illustration.

The cone pulley and spindle were removed and a long spindle, *A*, put in the lathe head bearings. At the



Lathe used as a vertical drill press

head of the lathe bed, *B*, are two bearings at right angles to the spindle. These bearings carry the drive shaft having a pulley on one end, at *C*, and a bevel pinion at the other, the latter driving the drilling spindle by the bevel gear shown at *D*. The tailstock spindle is fitted with a plate which becomes the horizontal drilling table *E*, when the lathe bed is bolted vertically to the large timber column in the shop.

The table is adjustable for height by moving the tailstock on the bed. The spindle feed is by the lever *F* at the top, the spindle being counterbalanced by a cord and counterweight. At the other side of the column is another, and standard, vertical drilling machine for larger work. But the small drill press made from the old lathe has proved very satisfactory.

Hardened Sockets and Sleeves for Drills

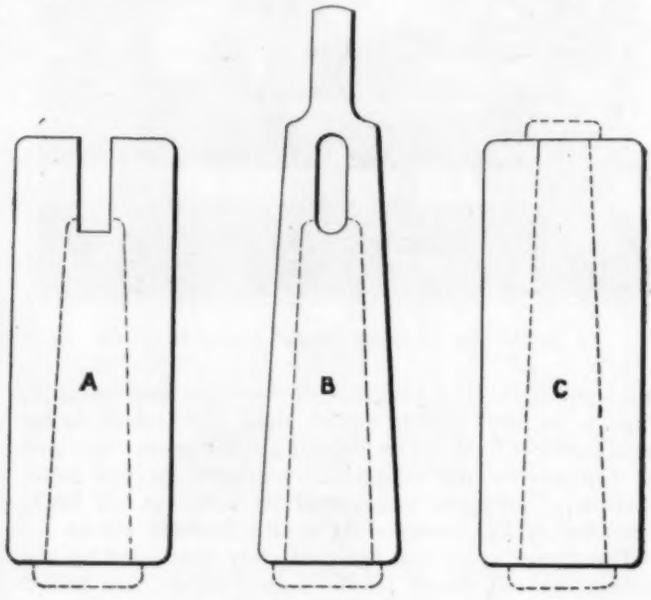
By K. H. Crumrine

Taper sockets, collets and sleeves for drills are usually left unhardened because of the practical certainty of distortion in hardening and the difficulty of grinding the taper bore to correct the error. The writer has a way of hardening such pieces upon the outside that will leave them true.

The sketches *A* and *B* show respectively a sleeve of the kind that is often used to hold taper-shank drills in the turret of a screw machine, and a collet for holding drills and other taper-shank tools in the drill press, lathe or milling machine.

To make the piece *A*, turn up the material in the usual way, leaving sufficient allowance on the outside to grind to size and leaving a projection as indicated by the dotted lines at the end of the piece. Next, put it in the case-hardening furnace and carbonize it deeply but do not harden it. Now face off the projecting button of carbonized material from one end and saw the required slot at the other.

The piece can now be hardened, and, as there is no longer any material at the end that is capable of being



Drill collets with hardened surfaces

hardened there is nothing to prevent swinging it up and boring and reaming the taper hole with the usual tools. The piece can then be ground to dimensions upon the outside while running upon a plug arbor made for the purpose, and you have a sleeve that is hardened all over on the outside and still runs true with the bore.

The same method of procedure is followed to make the collet. Leave the button of extra material at what is to be the open end of the taper hole and mill the tang, but do not yet make the slot. After carbonizing the piece the button is faced off and the slot drilled and broached in the ordinary manner, after which the piece is hardened and the taper hole made as before described.

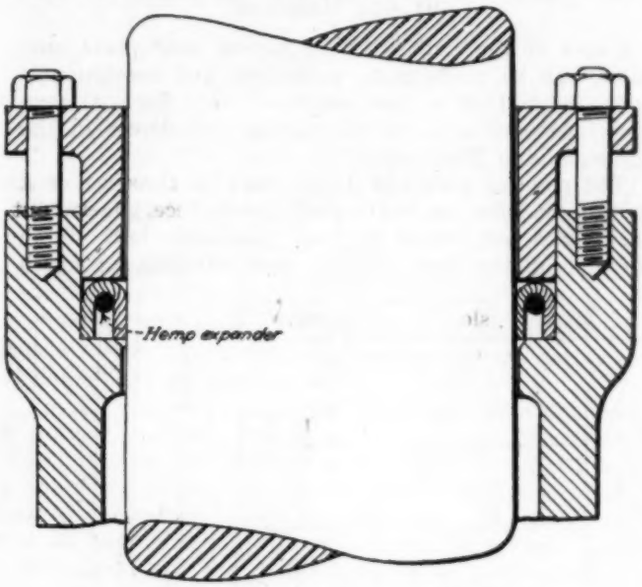
If the piece to be made has a through hole, as at *C*, it will be necessary to leave a button of material at both ends.

Putting Brass Liners in Hydraulic Jacks—Discussion

By Harry Ensminger

Referring to an article on page 599, Vol. 60, of *American Machinist*, by William J. Fisher, Jr., onder the title given above, I would like to ask why go to the expense of putting brass liners in hydraulic cylinders.

My experience has brought me in touch with many



Packing for hydraulic cylinders

types of hydraulic cylinders, both from the designing and the manufacturing viewpoints, and though I have conducted many experiments, I have not found it necessary to line the cylinder or to jacket the ram. I recommend grinding the ram to a diameter of $\frac{1}{64}$ in. less than the bore of the cylinder and assembling the parts with a U-packing and hemp expander as shown in the accompanying sketch.

A packing of this type with an adjustable gland on top of it is simple and economical, and will be found excellent for all purposes.

Screw-Machine Production Calculator —Discussion

By H. E. Warren

The article under the title given above by C. Houghton Hoisington, published on page 26, Vol. 61, of the *American Machinist*, is very interesting as a description of a handy device for calculating the number of parts that can be made in an hour or a day on the automatic screw machine. It is also of interest on account of the way in which the sample problem is worked out, for it has always been a mystery to me how the manufacturers of such machines figure the estimates of production which they give when trying to sell a machine.

However, when we analyze the calculation of time to make one piece, or the number of pieces per day, there appears to be something missing. Assuming that the speeds and feeds as given are correct, the time to make one piece would be the time required to do the actual cutting on this piece, whereas we always find it necessary to return the tool-slide and index the turret, as well as to stop the high speed movement at least $\frac{1}{8}$ in. before the tools start to cut, so that there may be no danger of digging in.

It is necessary, also, to put in new bars of stock occasionally; which means that we lose eight or more pieces each time new bars are put in, depending upon how soon the operator notices that the stock has been used up. When we add to this the fact that we have to grind tools and make adjustments occasionally—or even more often—we find that the production we may reasonably expect to get is nearer to 2,200 pieces per day than the 3,270 pieces that Mr. Hoisington figures.

Of course we do not know that the estimated production is actually figured by Mr. Hoisington on real jobs in this manner, but from our twelve years of experience in trying to get in actual production what the manufacturers of screw machinery estimate should be gotten, leads us to believe that the example quoted in the above mentioned article is a fair sample of the way they do it.

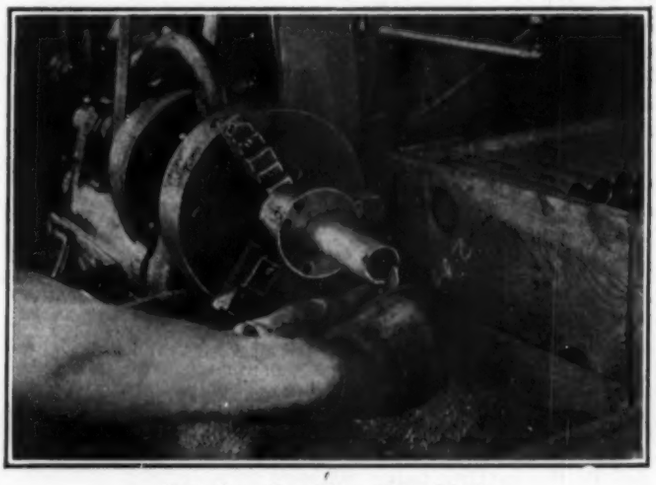
Removing the Burrs from Cut Tubing

By Jack Williams

The illustration shows a method of removing the burrs from cut lengths of tubing that is not only rapid and effective but involves no expensive preparation.

The piece of metal that may be seen in the jaws of the lathe chuck, is scrap—any old piece of junk will do. It is chucked and bored to a diameter of 0.002 to 0.005 in. above the size of the tube and that is all there is to it; it remains right where it was bored and is not disturbed until the burring job is finished, when it is again thrown into the scrap box.

The burring tool is the familiar scraper made by grinding sharp the corners of a small "three-square" or saw-file. The lathe is allowed to run continuously, the



Burring short lengths of tube

operator inserting and withdrawing the short pieces of tube with his left hand while with his right he manipulates the tool.

The excess diameter of the hole over that of the tube permits the later to be inserted easily, yet is not enough larger to allow the tube to wabble. The downward pressure of the tool at the outer end of the tube causes a cramping effect, due to the difference in diameter of the tube and the hole, that insures a drive sufficiently positive to do the work. Six tubes per minute, both ends, is a rate that easily can be maintained by the operator.

Bending Iron Castings

By Donald A. Hampson

At first thought the idea of bending iron castings would seem to be preposterous, but upon mature consideration the possibility of its being done under some conditions might be admitted. Actually it is being done, upon both hot and cold castings, in many shops.

The bending of castings is a trick of the foundry rather than of the machine shop, but it is often practiced in the latter in order to save a casting when only one is available and that one is needed badly. One shop had some parts that were very much like ladders in size and form, and were 6 ft. long. Occasionally these parts would come from the foundry with such a bend in the straightway portion that they would not clean up, and the practice was to heat that portion (and a little more) to a red heat and weight it down for cooling. It called for some watching until experience showed how heavily to weight the softened part, but the results were satisfactory.

In making surface plates from castings secured from a jobbing foundry, the writer has helped the foundry save two day's work and a ton of iron by building a fire under the castings that were crooked, blocking them so that the "arch" was upward, and letting the weight of the casting straighten it out as the heat took effect.

Quite recently a special machine was taken from the ruins of a burned building with the intention of restoring it, if possible. Apparently it had been red hot and while in that condition some object had fallen on the overhanging ends of the bed, which were T-shaped extension rails for the table to run out on, bending the rails down more than a quarter-inch. The stripped bed was clamped, rails down, on the table of a heavy planer; straightening out the warped section somewhat in so doing. Then the underside of the rails were peened until the metal spread enough to allow more straightening with the clamps and then more peening to hold the iron in the strained position. By this method the ways were restored to an average straightness that could be machined with a very light cut.

Another class of bending proves that there is more or less elasticity in iron castings. Light gray iron castings of I-beam section from 10 to 20 in. long, 1 in. width of flange and from 2 to 4 in. wide, were machined all over on the outside. The operations were first to grind the edges of the flanges to provide true clamping faces and then to mill the sides—which were the faces of the flanges. When taken from the milling machine, the castings would sometimes be sprung, the odd feature being that the cuts on the sides would cause a spring in the flange edges. This error might run as much as $\frac{1}{32}$ in. on a piece 15 in. long, and was not due to the casting being clamped in a sprung position. The same error would develop in castings of about the same weight and length but made with the web at one side—channel section, the parts being miniature surface plates.

The remedy for these sprung castings was the same in both cases. They were straightened cold in a bench press, just as would have been done if they had been made of steel, except that care was required not to spring the castings too far the other side of a straight line. The castings that had a wind in them were clamped near one end to a planer table with the major part of the casting projecting over the side. Then they were twisted with a monkey wrench until by trial it was found that the right amount of set had taken place.

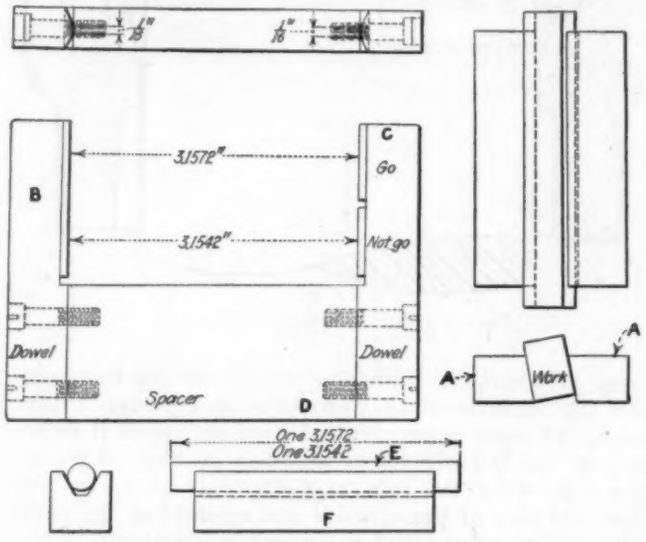
So far as is known, these sprung pieces stayed straight. No complaints were ever received and they go into work that is required to be within 0.001-in. limit of error.

Making Built-Up Gages

By Gus Haessler

Gages of the built-up type, having only plane surfaces, can be made quite accurately and conveniently with the aid of a few simple tools. Such a gage and the tools used in its making are shown in the accompanying illustration.

The angular parallels *A* are used in the vise of a milling machine for locating the jaws of the gage while the angles are milled to lines previously laid off on the ends of the work, and the same parallels are again



Built-up gage and tools for making it

used to hold them on the magnetic chuck when grinding the same angular faces after they are hardened. It is clear that these two parallels are the only special tools required to complete the jaws of the gage.

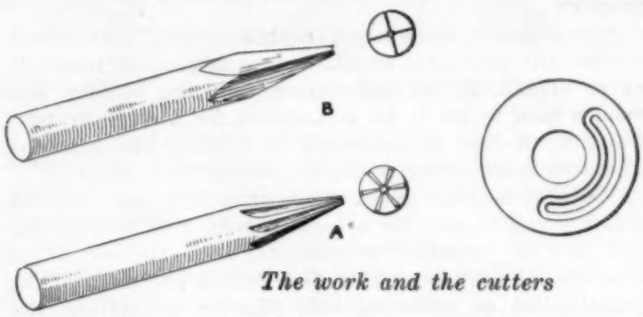
Having finished the jaws *B* and *C*, the piece *B* is secured to the end of the partly finished spacer *D* by means of its holding screws and dowels. The combined piece of work is then clamped lightly to the vertical face of an accurate angle plate, with the unfinished end of the spacer projecting above the plate. Before tightening the clamps finally, the angle plate is placed on a surface plate and the measuring face of *B* brought parallel thereto; testing it for parallelism with a dial indicator. The unfinished end of the spacer can then by ground accurately to dimension.

For the purpose of checking the gage during the final grinding, the end-measuring rods *E* are very convenient. They are made of drill rod of suitable size by hardening the ends and grinding them to length while held in the V-block *F*, which is the only other special tool needed. The V-block, with the drill rod in place, is clamped to the platen of a cutter-grinding machine and the rod moved up and down past the face of a suitably recessed wheel by means of the vertical screw, while the cross screw is used to feed the stock toward the wheel.

Evolution of a Milling Cutter

By F. W. Bach

Some years ago, while working upon some special model work, a fellow workman of mine had occasion to mill a V-sectioned groove part way round the face of a small circular piece, as shown in the accompanying sketch. The groove was about ⅛ in. wide at the top and ¼ in. deep, the sides being tapered so that the width at



The work and the cutters

the bottom was 1/32 in. The radius to which the groove was cut was 1/16 in., and it extended around the center to include about 100 degrees.

To mill this slot my friend first made from drill-rod a formed end-mill, shaped as at *A*, having six teeth. While milling the first of several pieces he had the misfortune to break four of the teeth out of the cutter, leaving two teeth opposite to each other. He thereupon ground away the jagged remains of the broken teeth and finished the first piece with it as a two-toothed cutter.

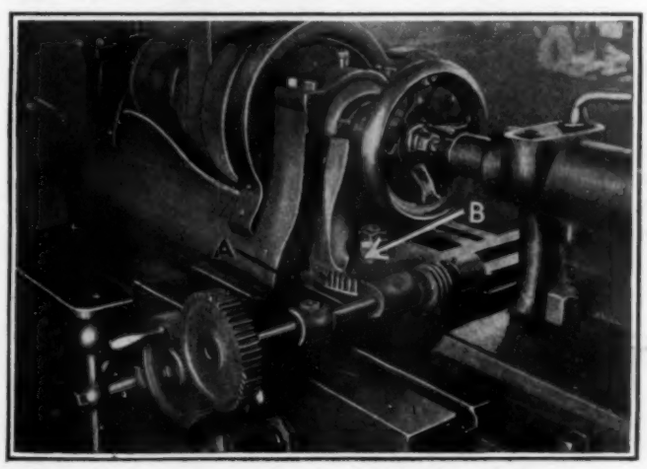
Upon starting the next piece the two remaining teeth broke, and my friend then made a cutter shaped as at *B* in the sketch, with which he finished the job.

This cutter may not be new to many of the readers, but to those who have never seen it I can recommend it as an excellent tool for such a purpose.

A Device for Turning the Rims of Handwheels

By Jack Williams

Here is a device for turning the rims of handwheels for lathes and other machines. It was made a good many years ago in the shops of the Porter Machine Works, builder of lathes, at Hatfield, Mass., for use in its own work and is still serving its purpose.



Turning the rims of handwheels

The regular toolblock was taken off a lathe and the special base *A* fitted in its place. This base has no screw adjustment, but it may be placed anywhere along the bridge of the carriage, according to the nominal diameter of the handwheel to be turned, and clamped by means of gibscrews.

A stud, *B*, in the center of the base, carries a worm-wheel upon which is mounted a toolpost that extends up to and beyond the level of the lathe centers. A cross-hole in the toolpost at the right height and of suitable size to take a toolbit of high-speed steel, and a setscrew in the top to hold the bit, complete this part of the outfit.

Power feed for the device is obtained from the regular power cross-feed of the lathe. Since there is no nut in the base, the cross-feed screw can turn idly without disturbing any adjustment, and all that remains is to fit a gear in place of the regular handle to mesh with a similar gear on the worm shaft.

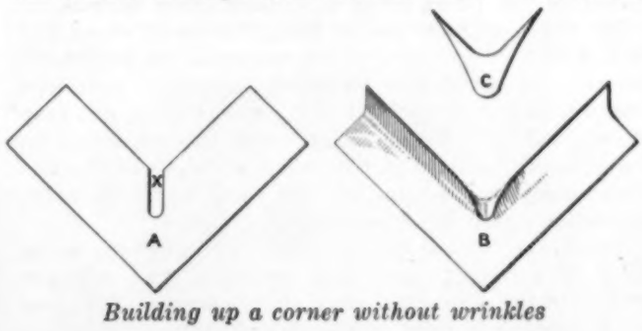
The latter gear can be fastened anywhere along the worm shaft by a wedge key. The extra length of shaft and the adjustable setting of the gear is to provide for different positions of the base along the bridge of the carriage, as larger or smaller handwheels are to be turned.

No elaborate means of setting either the base or the tool is provided, for the reason that exact diameters of wheels or radii of rim-sections are not necessary on this class of work. Both features are determined by the pattern from which the wheels are cast, and the duty of the device is merely to "clean up" the rim. It makes a good smooth cut, and little polishing is necessary.

A Substitute for Wrinkled Corners

By Henry C. Francis

An automobile body builder, who caters to the so-called exclusive trade, and consequently does not manufacture in large quantities, had a corner piece as shown at *B*. The material was about 1/16 in. aluminum and there was trouble with the corner wrinkling when it was drawn to shape from the flat sheet. One of his



Building up a corner without wrinkles

men suggested the way out by making it a plain bending operation.

The piece was first blanked as at *A*, the corner being cut out as at *X*. The next operation merely bent up the inner edges as shown at *B*.

This bending operation opened out the slot to about the shape shown. The small piece *C* was then formed up to fit the opening and welded in with a torch.

It seems like a roundabout way of doing the job but the dies are inexpensive and there is no possibility of the piece wrinkling at the corner, simple blanking and forming being all that is necessary.

American Machinist

Established 1877

KENNETH H. CONDIT AND FRED H. COLVIN, *Editors*

The Beginning of Better Times

THERE is a universal feeling of satisfaction upon the agreement of the international conference on the Dawes plan. The effect upon industry of real peace in Europe is certain to be pronounced. After ratification of the agreement by the nations concerned, will begin the financial stabilization in Germany which will influence the economic situation in all of Europe.

The United States will benefit as Europe, her greatest export market, improves. As the Department of Commerce has pointed out, the consuming power of the entire world will be increased, and the greater demand for goods will cause a general rise in the standard of living all over the world.

Stability of exchange will be approached now that the nations know where they stand. That security of mind which will result from tried operation of the Dawes plan will of itself mean increased business and increased prosperity to the whole world. The betterments will not take place at once; time is required for so great a change. However, things are started.

Improved Railway Earnings

IN SPITE of the fears expressed by some railway managers the railroads have, as a whole, been fairly prosperous during the past two years, according to the *Wall Street Journal*. Reasonable rates allowed them to make money which they have spent for much-needed locomotives, cars and other equipment. A goodly sum has been expended by some roads in replacing old machinery and in buying new machine tools for their various shops. Even the high wage rates, that were protested by many, have not prevented the earning of money during times which have been below normal.

The proposed reduction of freight rates in wheat and corn would, it is stated, have amounted to $9,300,000 annually on wheat and $5,800,000 on corn. Just how this would have benefitted the farmers it is not easy to see, and it becomes insignificant in comparison to the amounts involved in the recent advances of the two grains mentioned, amounting, for wheat, to $868,000,000, according to the same authority.

There are two classes of critics of railways, as on most other questions. One considers the railways always in the right, the other always wrong. Needless to say neither is right in the attitude taken. Railways are suffering largely from their sins of the past. They are absolutely necessary to modern civilization and must be run to give service as well as dividends. They must be permitted to earn a fair return on the investment and no political hamstring can be tolerated. But no industry that is so vital to a nation as are the railways can escape from governmental regulation, some of which may at times be burdensome and even unwise. The railway manager of to-day recognizes this and is succeeding in spite of it.

Sometimes There is Too Much Service

AT TIMES it seems that there are too many calls for field service on new machines and that such service is too freely handed out. Where a large machine is shipped partly dismantled or where an unusually complicated machine is sent out, it is best to send the builder's own man to see that it gets to running properly.

But where a machine of ordinary type, with which almost any mechanic should be acquainted, is received, there should be no expectation that the builder will send a man to set it up and run it for a week or two. Usually all that is necessary is leveling the machine and arranging either motor or countershaft drive.

When something goes wrong on a new machine and a hurry call is sent for a service man, it is well to find out if the trouble is due to some imperfection that should have been remedied before shipment. The possibilities of reducing field service by getting the machine right before it leaves the factory are worth thinking about. An analysis of service calls over a period of years would no doubt tell an interesting story. At any rate, every plant ought to keep service records and use them, too.

Get Rid of Lame-Duck Equipment—Now!

THERE is hardly a shop without its share of lame-duck equipment—machine tools or poor handling devices which the manager means to get rid of when the time comes. The main trouble in hanging on to these purloiners of profit is that the time comes, and passes, without its being realized.

According to several studies of business conditions the corner has been turned and the up-grade is beginning to show. Past experience teaches us that when orders start coming they are both urgent and critical as to price. That lame-duck equipment stands in the way of both quick delivery and low production costs. It will be a real handicap a little later. The shops which still cling to it should get rid of it now.

Money is cheap, which makes the present a good time to buy new equipment to replace that which is not thoroughly efficient. And the buying should not be considered as an expense but an investment, just as when we buy bonds of any corporation, generally issued to enable them to buy new equipment.

Such investments are to be encouraged, *after* you have invested in new machinery for your own plant, not before. The chances are your money can earn a much bigger return invested in your own shop than elsewhere.

Unless the money it borrows from you enables the other corporation to earn more than it pays you in dividends, your investment is not sound. And if more is earned, the surplus always stays with the other corporation.

Why not get this surplus dividend yourself?

For the Foreman

THE foreman is not necessarily a good clerk, nor is a good clerk necessarily a good foreman.

The machine is not working efficiently when it gets hot. Neither is the foreman.

Shop Equipment News

Lees-Bradner Single-Purpose Gear Generator

Designed primarily for the production of automobile transmission gears, the gear generator recently placed on the market by the Lees-Bradner Co., 6100 Carnegie Ave., Cleveland, Ohio, is characterized by the rigidity of the mounting of the hob and the work and the simplicity and directness of the drive. Although this machine incorporates a number of the features of former models made by this company, the general appearance of the machine is quite different, as an examination of the accompanying illustrations will show. It is termed a single-purpose machine, not because there is any limitation on the number of teeth cut, the thread angle or the diameter of the hob, but on account of the limited class of work that can be handled.

The gear blank is fed past the hob as the teeth are being cut, in accordance with the practice of this company. The relative movements and positions of the spindles are not unlike former Lees-Bradner machines, the greatest departure being made in the design of the surrounding housing and the gear train between the hob and the work spindles. The manner in which the housing completely surrounds the hob and the work avoids overhang and permits the establishment of an additional bearing for the work slide against the top of the housing. This bearing can be seen in Fig. 2 above the work.

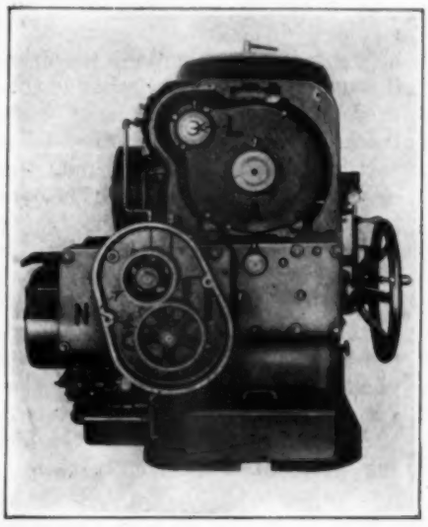
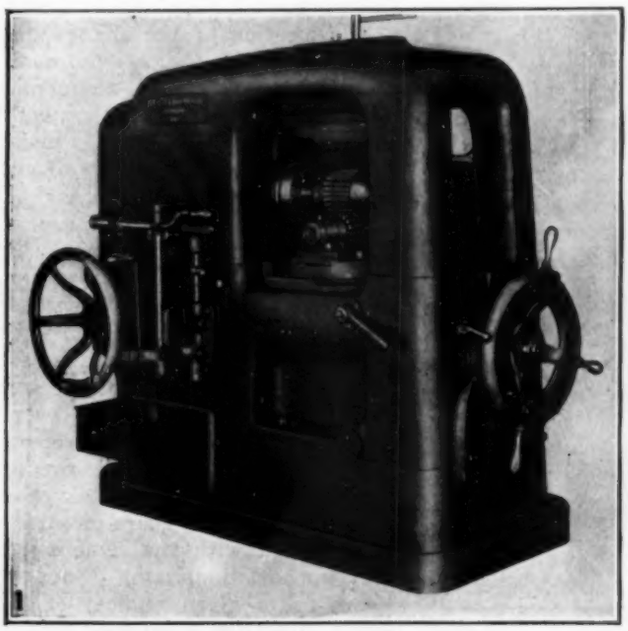


Fig. 3—Rear of Lees-Bradner generator with covers removed

The rear end of the machine with the cover plates removed is shown in Fig. 3. The manner in which the work spindle head *A* is gibbed to the bed of the machine is apparent from this illustration, the bearings being liberal in size. A tapered gib which is not shown provides an additional restraint against side movement. The work spindle has no vertical adjustment and travels only in a longitudinal direction to give the feed and return of the work.

Varying diameters of work are accommodated by a vertical adjustment of the support that carries the hob spindle. Fig. 4 shows in diagram how this adjustment is made. Instead of employing a vertical screw, a large, wedge-shaped casting *A* supports the cutter head as shown. The wedge is moved horizontally along the bed of the machine to adjust the vertical position of the hob and, in effect, the cutter head rests upon a solid cast-iron foundation of which



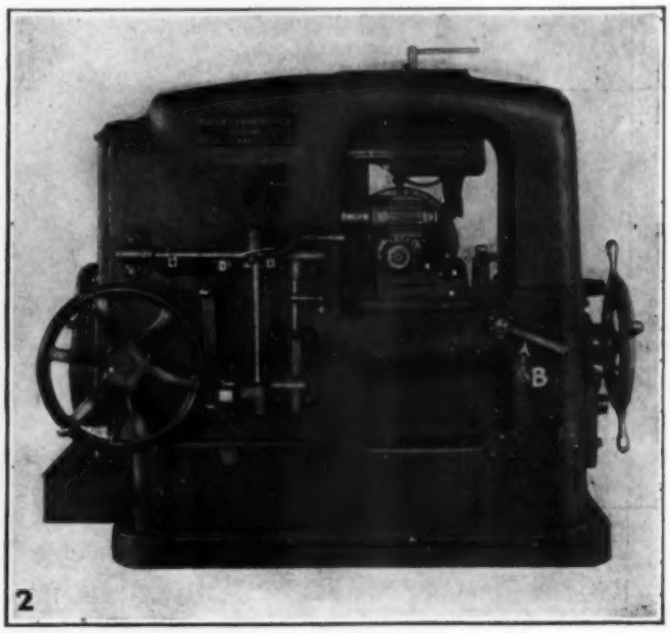


Fig. 1—Lees-Bradner Single-Purpose Gear Generator. Fig. 2—Control side of the machine

the bed of the machine is a part. The wedge is positioned by means of the pilot wheel at the front of the machine, this wheel being geared to the traversing screw for the wedge. When the hob has been adjusted to

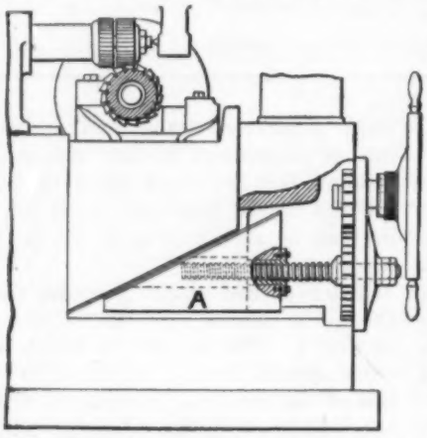


Fig. 4—Diagram showing adjustment for height of hob

the proper height, its support is clamped to the bed of the machine by means of the small hand lever *B*, Fig. 2, located near the front of the machine.

A cutter head made in one piece is furnished, instead of the usual swivel head. Since the machine is designed for cutting spur gears only, it is not necessary for the head to swivel through a large angle. The small amount of adjustment required to accommodate hobs with the thread angles used on this class of work is obtained by loosening the holding bolts and swinging the head about the center of the vertical shaft which drives the hob spindle.

The maximum angular adjustment of the head is 10 degrees and, since there is no occasion for the use of left-hand hobs on this class of work, the adjustment is all on one side of the center. With this arrangement the head will accommodate right-hand hobs of any thread angle up to 10 degrees, including spline hobs and single-, double- or triple-thread hobs of all pitches used for the production of automobile transmission gears. When the clamping bolts are tightened, clamping the head to the support, and the support is clamped to the bed, an exceptionally rigid mounting for the hob is maintained.

A heavy flywheel *C*, Fig. 5, is mounted directly on the end of the hob spindle. The spindle is driven through a worm gear similar to those used in the axles of heavy motor trucks. The worm is splined to the vertical shaft *D*, Fig. 5, and is enclosed in the housing *E*. The large bronze wormwheel is mounted on the hob spindle. This gearing is lubricated by a continuous flow of oil from a pump, the oil returning to a suitable reservoir after passing over the gears. The machine has two pumps and two lubricating systems, one for oil and one for the coolant.

A diagrammatic view of the driving mechanism of the machine is shown in Fig. 6. The driving pulley *F* is mounted on a horizontal shaft to which the pulley *M* for driving the lubricating pump is also secured. This horizontal shaft carries at its inner end a miter gear which

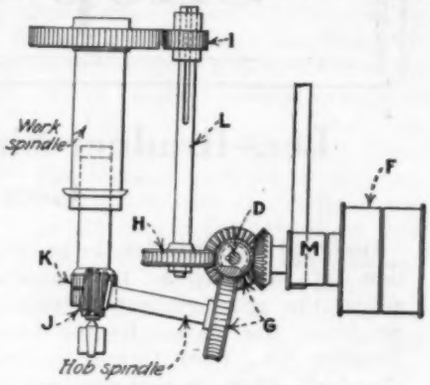


Fig. 6—Diagrammatic view of driving mechanism

meshes with a similar gear on the vertical shaft *D*. The arrangement through which this shaft drives the hob spindle through the worm gearing *G* has already been described, and the positions of the hob and the work are shown at *J* and *K*, respectively.

At the top of the vertical shaft *D* another worm is fastened and drives the wormwheel *H* attached to the horizontal shaft *L*. The position of this shaft in relation to the rest of the machine is shown also in Fig. 3. A spur pinion is splined to the rear end of the shaft *L* and meshes with a large gear on the work spindle. Both of these gears are carried by the work spindle head. It will be noted that there are but three pairs of gears between the hob and the work.

The location of the change gears that control the feed is shown at *N* in Fig. 3. They are mounted on fixed centers so that both must be changed to vary the feed. In making a set-up there are two pairs of gears on the machine to be changed—the feed gears and the worm gears at the top of the vertical drive shaft. The latter are changed whenever it is necessary to cut a different number of teeth or to use a hob with a different number of threads, since they control the speed ratio between the hob and the work. A cover *O*, Fig. 5, at the top of the worm housing and a similar cover over the wormwheel are removed to change these gears. Both gears of this pair are marked with the same number and a chart indicating the proper gears for a given number of teeth and a given hob is supplied.

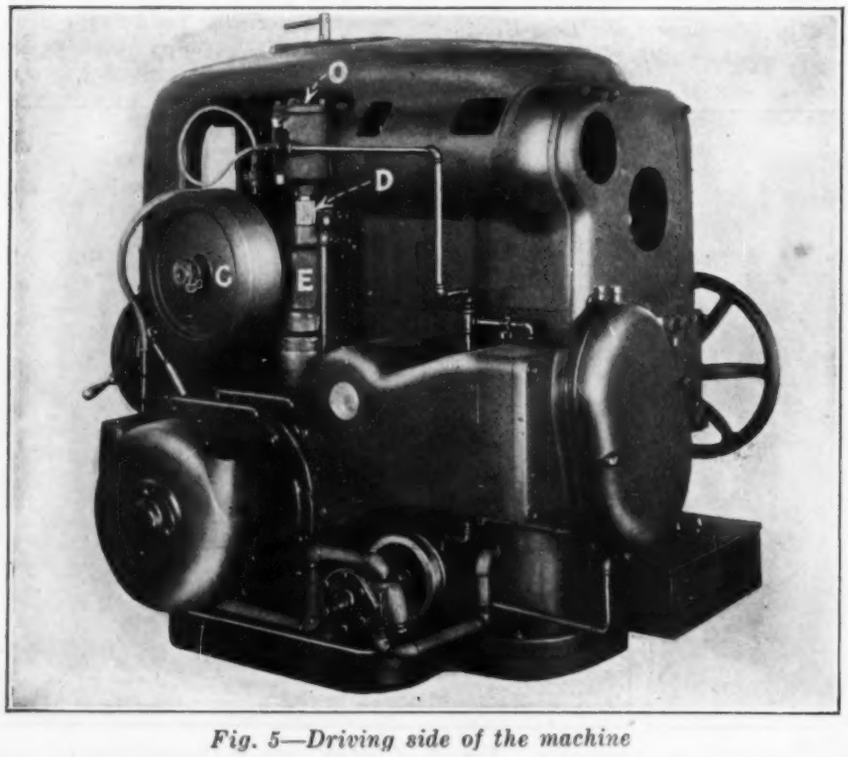


Fig. 5—Driving side of the machine

The provisions made for easy changes of set-up are not incorporated in the machine in order to make it universal in any sense, but in order to allow each machine in a plant to be operated at a suitable speed and with a suitable diameter of hob. The machine adapts itself to such conditions as a change in design which calls for a different number of teeth or conditions which make necessary a change in the hob diameter. One pair of feed gears and one pair of rotation gears are furnished, and special gears to suit varying conditions can be provided, if required.

In addition to a power quick return for the work slide, there is also a power-operated quick approach for starting the cut. All control levers are located in convenient positions for the operator. The coolant reservoir, pump, piping and chute for the chips are all made sufficiently large to accommodate the large amount of metal removed.

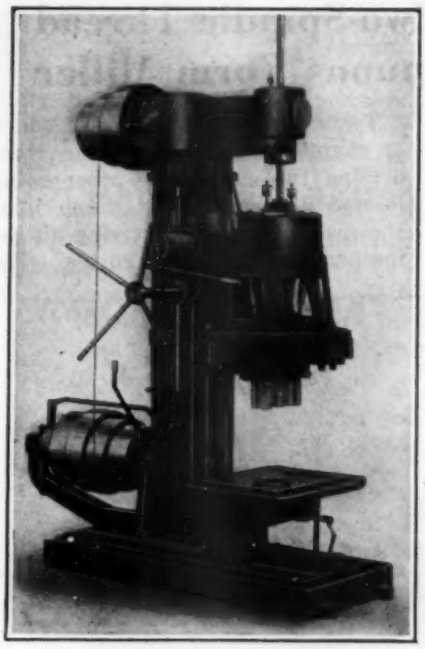
Fox No. 22 Type A Multiple Drilling Machine

A recent product of the Fox Machine Co., Jackson, Mich., is the No. 22, type A, multiple-spindle drilling machine shown in the accompanying illustration. The feature of the machine is the small number of parts for transmitting the power from the main drive pulley to the drill spindles.

The base of the machine is heavily ribbed and the column has a box section. The table regularly furnished is of the adjustable, knee type with a planed top surface 18x24 in. Box tables or rotary tables can be furnished.

The main drive pulley runs on Hyatt roller bearings and the recommended speed is 450 r.p.m. The power is transmitted through an Edgemont single-disk clutch mounted inside the pulley. The upper cone pulley is secured to a shaft that runs in ball bearings and carries a bevel pinion meshing with a bevel gear on the vertical drive shaft. The vertical shaft is also mounted in ball bearings. The cone pulleys give three spindle speeds.

Three gears for the feed are mounted on the upper cone pulley shaft. A three-step cone gear is carried on an auxiliary shaft and can be brought into proper mesh by the lever on the side of the gear case at the top of the column. The



Fox No. 22 Type A Multiple Drilling Machine

vertical feed shaft to the drill head is driven through worm gearing. All feed gearing and shafts are lubricated by means of a splash system. A force feed lubricating system can be supplied, if desired, with the pump mounted on the side of the column.

The saddle has an exceptionally long bearing on the column and the drilling head is securely bolted to the saddle. The head gearing for the spindles permits the use of two speeds, so that drills of different diameter can be run at the proper speed. Any spindle not in use can also be stopped. The drilling area covered by the head is 12x18 in. rectangular, or 16 in. round. The vertical travel of the head is 24 in., the maximum distance from the base to the under side of the head being 46½ inches.

Universal joints with but three parts are incorporated in this machine and tend to reduce the troubles sometimes caused by these parts. No screws, rivets or pins are required in these joints as they are composed of two solid forks and a solid square center piece. The joints are driven by keys instead of taper pins and can be quickly and easily removed.

The drilling spindles run in bronze bushings and are furnished with ball thrust bearings. The adjustment of each spindle to its drilling position is convenient and is accomplished after releasing one nut. Vertical adjustment of the spindles is also possible. Cluster plates are used on this machine for straight production work.

The over-all floor space required by the machine is 44x74 in., and 14 hp. is necessary for driving. The net weight of the machine is 5,150 pounds.

Buffalo Improved No. 2 Woodworker

The Buffalo Forge Co., 490 Broadway, Buffalo, N. Y., has recently effected an increase in the planing capacity of its No. 2 combination woodworker. This is the smallest of the woodworkers made by this company.

The planing head now incorporated in this machine makes possible the planing of boards up to 8 in. in width. The planer table is made in two parts that fit into the channel on the main table and are adjustable on an inclined plane. A hinged planer guide is supplied and any angle required for beveling can be obtained.

Buffalo Improved No. 2 Woodworker

The bandsaw table is of the tilting style and its surface is 17½x14¼ in. The table can be locked securely in the desired position. The machine is driven through gearing to insure smooth running conditions. The drive shaft is 1 in. in diameter and runs in babbitted and reamed bearings. The pulleys for the jointer and the bandsaw are connected to the drive shaft through jaw clutches, enabling independent operation.

If desired, the drive shaft may be connected to an electric motor or a gas engine. From 1 to 2 hp. is needed for the bandsaw, and up to 3 hp. for the rip saw. The drive shaft should run at 700 revolutions per minute.

Pratt & Whitney Two-Spindle Thread Hobber and Continuous Form Miller

A machine designed for high-production thread hobbing and circular milling operations has just been placed on the market by the Pratt & Whitney Co., Hartford, Conn. It can be equipped with a ring hob and a suitable lead cam for threading or with a formed or straight milling cutter without a lead cam for circular milling.

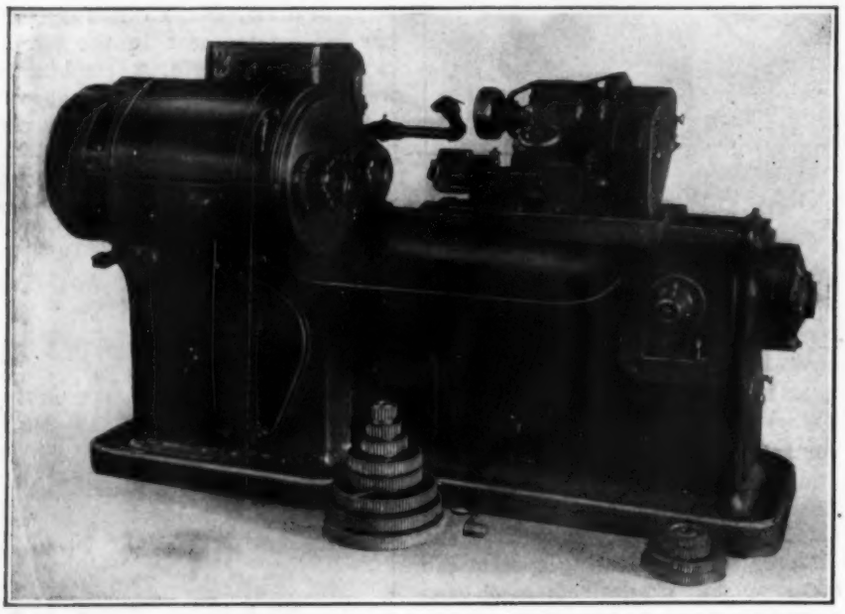


Fig. 1—Pratt & Whitney Two-Spindle Thread Hobber and Continuous Form Miller

As shown in the front view of the machine, Fig 1, two horizontal work spindles are mounted 180 deg. apart in a large drum that is automatically indexed through one-half of a revolution at regular intervals. A cutter head is arranged to slide on ways at the rear of the machine and carries a single cutter that is brought into engagement with the work held in the rear spindle. This spindle is slowly rotated during the milling operation, and for threading operations the cutter head is moved longitudinally by a cam to give the required lead for the thread.

While the work in the rear spindle is being machined the operator removes the finished work from the front spindle and replaces it with an unfinished blank. When indexing takes place the blank is carried into the operating position at the rear and the finished work is brought to the front where it can be removed. In this way, the operation of the machine is automatic except for loading and unloading.

Two motors are used, one of which is mounted on the cutter head for driving the cutter, the other being located at the rear of the bed, as shown in Fig. 2, and driving all the mechanism except the cutter. The latter motor has a capacity of 2 hp and transmits power through gearing and silent chains for driving the work spindles, indexing the large drum, rotating the cams for the lead and feed of the cutter, and operating the pump. The spindle gearing in the drum is arranged so that the front spindle is always stationary for loading and unloading. The rotation of the work spindle is controlled by means of 12 change gears and six changes of speed are available. The hole through the spindle will accommodate work that is 2 in. in diameter.

The work spindles are of steel, heat treated and ground, and the spindle noses are provided with both straight and taper bearing surfaces and threaded portions to accommodate the collet closing rings or special chucks. The drum is indexed by means of a large worm and wormwheel connected to the main drive through a friction clutch that is engaged and disengaged at the proper times by a cam. A positive automatic lock holds the drum at the indexing points and a cam-operated pawl releases the work as soon as the cut is finished. The indexing of the drum takes about 2 seconds.

The 2-hp. motor for driving the cutter transmits its power through transposing gears that provide speeds of 355 and 485 r.p.m. for the cutter. The cutter spindle is of special steel, hardened, ground and lapped, and is mounted in hardened bushings in the cutter head. The hole in the spindle has a No. 9 B. & S. taper. The cutter head is carried on a cross slide attached to the main longitudinal slide, the adjustment of the cross slide for the depth of cut being made by the handwheel shown in Fig. 3. The head may also be adjusted for any slight taper appearing in the work on ac-

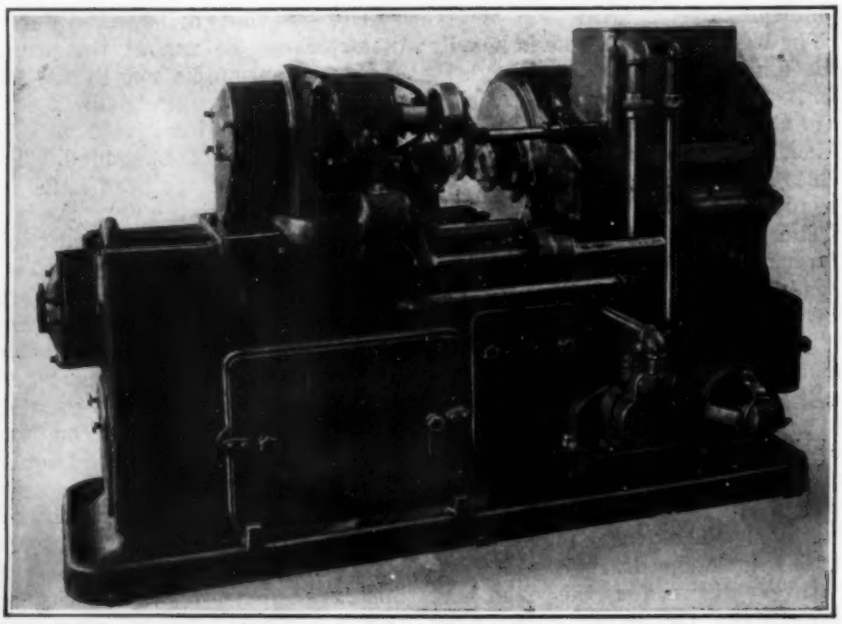


Fig. 2—Rear view of Pratt & Whitney two-spindle hobber and miller

count of inaccurate grinding of the hob and a dial indicator provides an easy means for accurate depth setting.

The lead cam for moving the longitudinal slide for threading consists of a cast-iron core and a hardened and ground lead ring which is removable and must be changed for each different pitch. By this mechanism the complete thread is finished during one revolution of the work. A second cam advances the

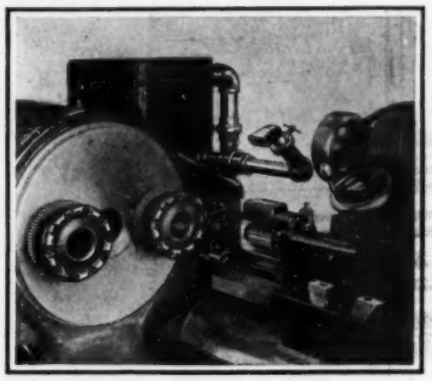


Fig. 3—Close view of spindles and cutter head on Pratt & Whitney hobber

cutter head crosswise the full depth of the thread, and at the proper time the cutter is released and backed away by a spring to allow the indexing of the drum. Thus the hob is fed longitudinally during the cut, is then backed away from the work, returns through the pitch distance traveled while cutting and moves in again to the proper depth, after the next piece has been indexed into position. For circular milling the longitudinal movement of the slide is omitted and the slide is locked, the cross slide being moved by its cam as in threading.

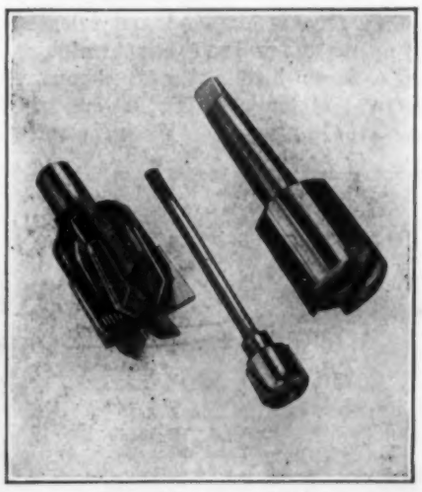
The maximum diameter of cutter that can be accommodated is 3 in. and a double support for the cutter spindle is available for long cuts. The machine can also be fitted with tailstocks for long work and pieces that are not adapted for chucking. These tailstocks are mounted on a long splined bar carried in the center of the drum and projecting between the spindles.

The coolant is pumped to a large reservoir at the top of the machine from which it flows by gravity to the cutter. The coolant pump is located at the rear of the machine and can be seen in Fig. 2. The flood of lubricant carries the chips to a settling box inside the bed and the pump draws its supply from this box.

If desired, the spindle can be fitted with air chucks for rapid operation, the opening and closing of the chucks being controlled by means of one valve. The motors are controlled from convenient push-button stations and the other controls are accessible and simple. The machine requires a floor space 98x52 in., the length being increased by 12 in. when air chucks are fitted. Work up 10 in. in diameter which does not require the use of centers may be chucked and the length available between centers when using the tailstocks is 18 inches.

O. K. Tool Co. Milling Cutters and Counterbores

The O. K. Tool Co., Shelton, Conn., has just brought out a line of inserted-tooth cutters and counterbores with an ingenious method of resetting to maintain the proper diameter when it has been lost through wear. The tool shown disassembled in the illustration may be used as an end mill or a counterbore. The pilot is separable and any size may be used with any counterbore. When the tool is used as a counterbore the stem of the pilot is threaded into the collet to hold the driving wings in



O. K. Tool Co. Milling Cutter and Counterbore

engagement. To use it as an end mill the shank of the collet is made hollow, the draw-bolt of the machine passes through it and screws into the shank of the tool body. Separate collets are necessary.

The teeth, of high-speed steel, are driven endwise into longitudinal slots. The backs of the teeth are serrated lengthwise, the serrations being spaced 0.050 in. apart. The serrations are cut with a formed milling cutter and, when the teeth are new, the serrations of all teeth are spaced equally from the cutting edges.

Corresponding serrations are broached in the slots of the tool body. The spacing between the serrations in the slots is the same as those of the teeth but, as each successive slot is broached, the broach is moved radially away from the center line a certain distance determined by the number of teeth in the cutter. When there are more than eight teeth in the cutter the radial adjustment of the broach is stopped at the eighth slot, the broach is returned to its zero position for the ninth slot and the sequence repeated. Thus, in a 16-tooth cutter there would be two, and in a 24-tooth cutter three, zero positions and complete sequences with respect to the radial disposition of the serrations. If the number of teeth in the cutter is not divisible by eight—as in a 6-, 12- or 18-tooth cutter—the radial advance of the broach would be stopped at six and the sequence repeated from there.

As the teeth are all alike they will, when first assembled into the cutter body, project varying distances from the center, a condition which is rectified by the grinding in the process of manufacture. When the diameter of the tool has been decreased by wear, the teeth are all driven out and reinserted in the slots as follows: The tooth that was in the first slot (zero position) is replaced in the second slot; the tooth that was in No. 2 slot is advanced to No. 3 and so on, until the last tooth of the sequence is advanced to occupy the next succeeding slot, which is at the zero position. To offset this change this last tooth is set out radially one serration in the next slot. The tool is now uniformly larger in diameter than it was originally, the amount depending upon the number of teeth in the tool, and it can be reground to its original size.

Resetting can be done in this way as many times as there are radial advances in the sequence before all of the teeth have been advanced one serration. As three or four of the serrations are available before the hold upon the tooth becomes too insecure to be trusted further, the life of the tool is indefinite. When it is no longer safe to advance the teeth further, they may be replaced by a new set.

"Milband" Metal Cutting-Off Machine

The Henry G. Thompson & Son Co., New Haven, Conn., has recently developed a cutting-off machine of the horizontal bandsaw type which is to be known by the trade name of "Milband." It has several features not usually applied to bandsaws for cutting metal, and is designed to cut stock of all sizes and shapes up to 6 in. square.

The swinging frame carrying the band-wheels is counterbalanced, so there is no tendency for the saw to "dig in" because of soft spots or thin sections. The positive feeding movement is gear-driven through a rack and pinion, is rigidly controlled, and the time of making a cut therefore depends upon the rate of feed for which the machine is set. This is in turn determined by the size and nature of the material. By reason of this feature the same bandsaw cuts thin-walled tube with the same continuity of movement as solid stock.

There are six changes of feed, all controlled by the small crank-lever seen in the front view of the machine. An instruction plate permanently attached to the machine shows the correct feed-setting for each grade of material and size of bar. As the machine is designed to cut anything from thin-walled tube to solid bars of annealed high-speed steel and monel metal, a multi-speed countershaft is provided to change the lineal speed of the band in accordance with the nature of the material being cut. The feed and speed settings for all kinds of material and for various sizes of bar stock by inches from one to six are shown by the plate.

The main drive is through bevel and miter gears having a reduction ratio of four to one to the lower band-wheel. From the first shaft power is taken off by a chain and sprocket to drive the bank of spur gears which, through a sliding key that is controlled by the feed lever, determine the rate of feed for any given material. A second chain drives a small centrifugal pump that supplies lubricant to the cut from a settling tank within the base of the machine.

The work-holding vise is double and the jaws are independently controlled, so that material to be cut is held firmly on both sides of the kerf. This feature permits the cutting of disks or slabs as thin as ⅛ in. without endangering the band or allowing the cut to creep sidewise. The band is guided both before and behind the cut by two pairs of hardened steel rollers mounted upon ball bearings. These rollers are permanently adjusted before the machine leaves the factory and the setting need never be disturbed.

The feed is engaged and released by means of a pull rod that terminates in a knob beside the feed-control lever. When starting a cut the operator pulls down the arm until the saw contacts with the work and then engages the feed clutch. The saw then cuts through the material at a continuous definite rate, established by the particular feed gears then in mesh, until the piece is cut off, when the feed is automatically disengaged.

A special blade, manufactured by the Henry G. Thompson & Son Co., is used upon all materials and at all speeds. The band is 12 ft. 11 in. long by ¾ in. wide and 0.031 in. thick. The teeth are pitched five to the inch and are "set" to make a kerf 0.050 in. wide. The idle band-wheel runs upon ball bearings and is supported by a screw-operated sliding block that is adjustable for the purpose of maintaining the proper tension upon the band.

The band is guarded upon the idle side and around both wheels by a rigid aluminum guard that protects the operator from injury. A band can easily be changed by the operator without assistance.

The machine as here shown is designed to be driven by a 2-in. belt from an overhead countershaft, but if desired a direct-connected motor may be substituted. The motor bracket is bolted to the rear of the base and a silent chain and sprockets are substituted for the belt and pulley.

The machine requires about 2 hp. to drive it. The floor space occupied by the belt-driven machine is 6 ft. by 3 ft. 8 in.—approximately 22 sq. ft. This machine weighs 1050 pounds.

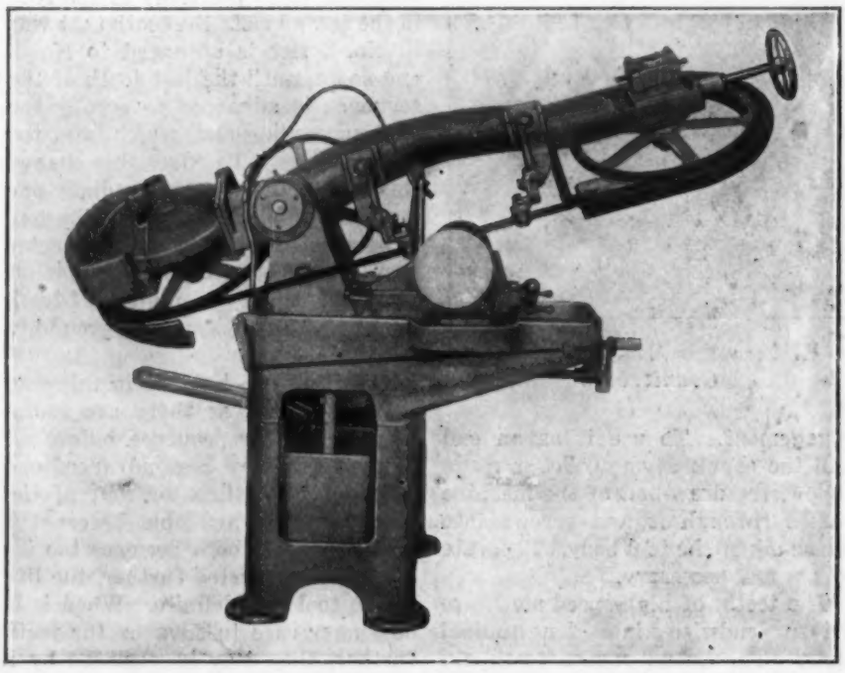


Fig. 1—"Milband" Metal Cutting-Off Machine

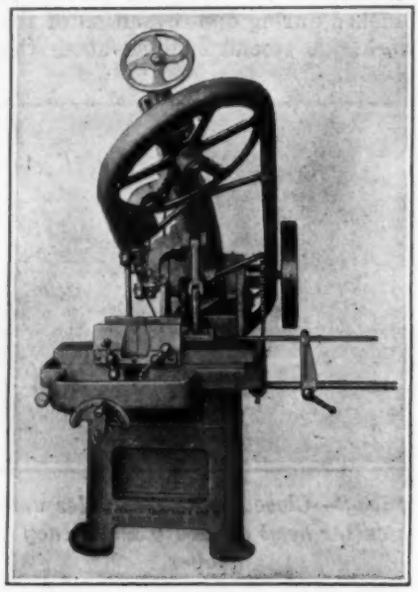


Fig. 2—The "Milband" machine from the operating position

Besly Thrust Washer Grinding Machine

An automatic machine for grinding the sides of bronze thrust washers has recently been completed and marketed by Charles H. Besly & Co., 118 N. Clinton St., Chicago, Ill. A front view of the machine is given in Fig. 1 and a closer view of the automatic feeding mechanism is shown in Fig. 2. The washers are of cast bronze $\frac{1}{8}$ in. thick, $3\frac{1}{8}$ in. in diameter, and have a $2\frac{1}{4}$-in. hole at the center. Since considerable accuracy is required and a comparatively large amount of material must be removed, both roughing and finishing operations are necessary.

The washers are placed in the inclined chute at the front of the machine as shown in Fig. 2, and are automatically fed into the holes in the feeding disk. This disk is $\frac{3}{16}$ in. thick and has four holes equally spaced. From the loading position the washer is carried down between the guide plates to the underside of the grinding disks and, when the piece is about $\frac{1}{4}$ in. from the edge of the grinding disks, the disks open, allowing the work to enter about two-thirds of its width. As the feeding disk carries the work through the machine, cams at the outer ends of the spindle gradually bring the grinding disks together and both sides of the washer are ground.

When the work has reached a point about $\frac{1}{4}$ in. from the outer edge of the grinding disk, the cams release the disks and the finished washer comes out at the top as another blank is being fed in at the bottom. The finished part is automatically ejected from the feeding disk into a chute down which it rolls to a suitable receptacle. Besly grinding disks are used, and it is said that these washers can be roughed at the rate of 1,800 per hour, and finished at the rate of 2,400 per hour.

This machine is designed for wet grinding and has a large water pan between the floor pedestals and the bed. The opposed wheel heads are arranged to slide on ways on the bed of the machine and carry the motors which are direct-connected to the spindles. Each spindle is driven by a $7\frac{1}{2}$-hp. motor and the spindles rotate in opposite directions so that the faces of the finished work will be parallel. The spindle bearings are arranged to slide endwise in the motor casings and the end bearings carry racks to mesh with the pinions that move the spindles to admit and release the work.

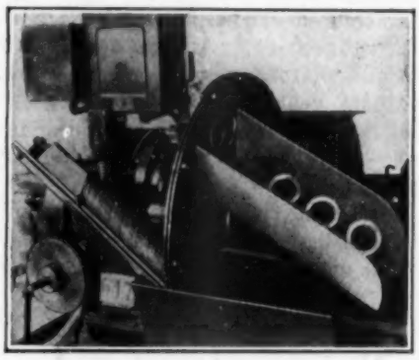


Fig. 2—Besly Automatic Feeding Mechanism for Thrust Washers

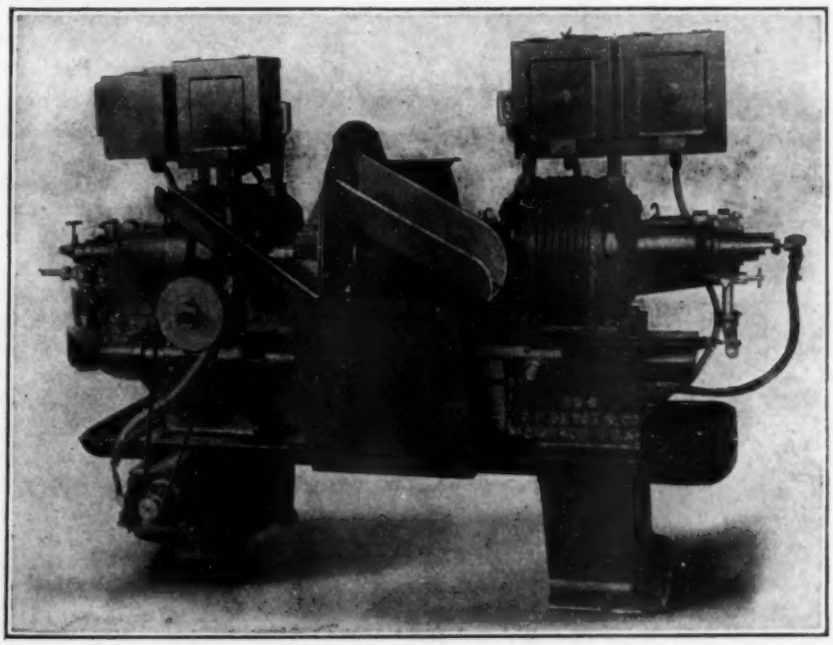


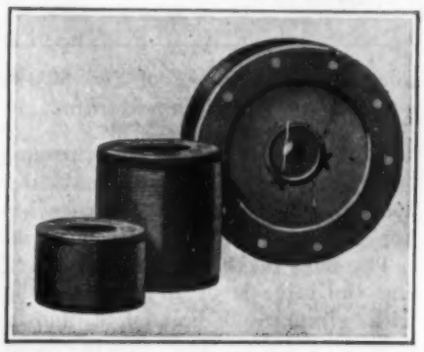
Fig. 1—Besly Thrust Washer Grinding Machine

Coolant is supplied to the grinding wheels by a direct-connected, motor-driven pump attached to a leg of the machine under the water pan. A 30-gallon, three-compartment settling tank acts as a reservoir and the liquid is pumped through piping to the outer ends of the hollow spindles.

The work-feeding mechanism is driven by a $\frac{1}{4}$-hp. motor through a belt and suitable reduction gearing. The cams that control the position of the wheels are driven from the feeding mechanism. The disk grinding wheels are of cast iron and are 20 in. in diameter. The faces of the wheels have spiral grooves to facilitate the cementing of the grinding disks. Besly "Titan" grinding disks are used. A wheel truing device is attached to the rear of the bed.

Best Pulley Manufacturing Co. Paper Pulleys

A recent addition to the products made by the Best Pulley Manufacturing Co., 400 Talcott Ave., St. Louis, Mo., is a complete line of paper pulleys. These pulleys are made of selected, treated paper fiber, hydraulically compressed into a solid block. The end grain of the fiber is exposed to the belt in order to provide a good grip.

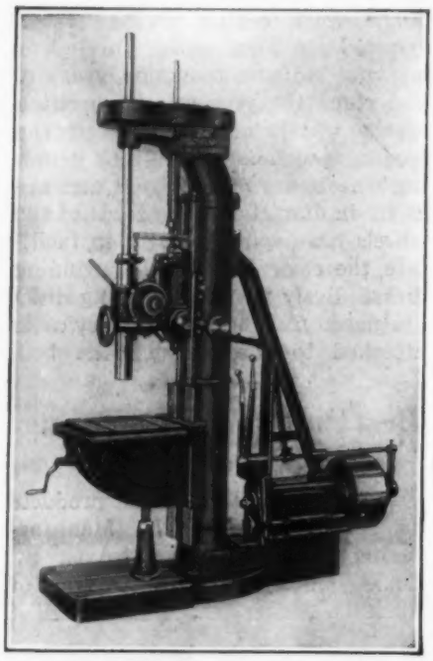


Best Pulley Manufacturing Co. Paper Pulleys

The hub has three sets of double ribs which lock the hub securely in the paper block and prevent it from coming loose. These ribs are designed to hold securely in either direction of rotation. The hub is hydraulically pressed into the pulley. Each pulley is carefully balanced and tested. Approximately 2,500 stock sizes are made.

Rockford Machine Tool Co. 24-In. Mechanics Drilling Machine

A 24-in. all-geared drilling machine of the self-oiling type, shown in the accompanying illustration, has recently been developed by the Rockford Machine Tool Co., 2410 Kishwaukee St., Rockford, Ill. The machine is of heavy construction and is so designed that all parts are accessible and interchangeable. All



Rockford Machine Tool Co. 24-In. Mechanics Drilling Machine

bearings are bushed with bronze bushings that are automatically flooded with oil, all moving parts being encased and also flooded with oil.

The base of the machine is heavy and the table is of the square type with standard T-bolt slots and a large oil trough. The table is gibbed to vertical ways and is supported by a screw that can be operated to raise or lower the table by means of a crank. When locked in position, the table is rigid.

The head is gibbed to vertical ways on the column and suitable adjustment for wear is provided. The head is a self-contained unit, carrying the feed mechanism. All working parts are enclosed and run in an oil bath. Special attention has been paid to the gear centers to insure quietness and long life. The spindle is of high carbon steel, accurately ground, and is provided with a No. 4 Morse taper. The spindle thrust bearing is of the ball type.

The speed-change gear box is cast integral with the base to afford a rigid support for the gear shafts. Nine changes of speed are available, the gears being controlled by two levers within easy reach of the operator. The gears are heat-treated and run in an oil bath. All bearings are bushed with self-oiling bronze bushings which can be removed conveniently in case of wear. Power is transmitted from the change gears to the feed mechanism and spindle through a vertical shaft encased by the column and supported by a ball thrust bearing. At the upper end of the shaft a spur gear drives the spindle gear through an idler, all gears being encased and running in oil. The idler gear drives the feed mechanism.

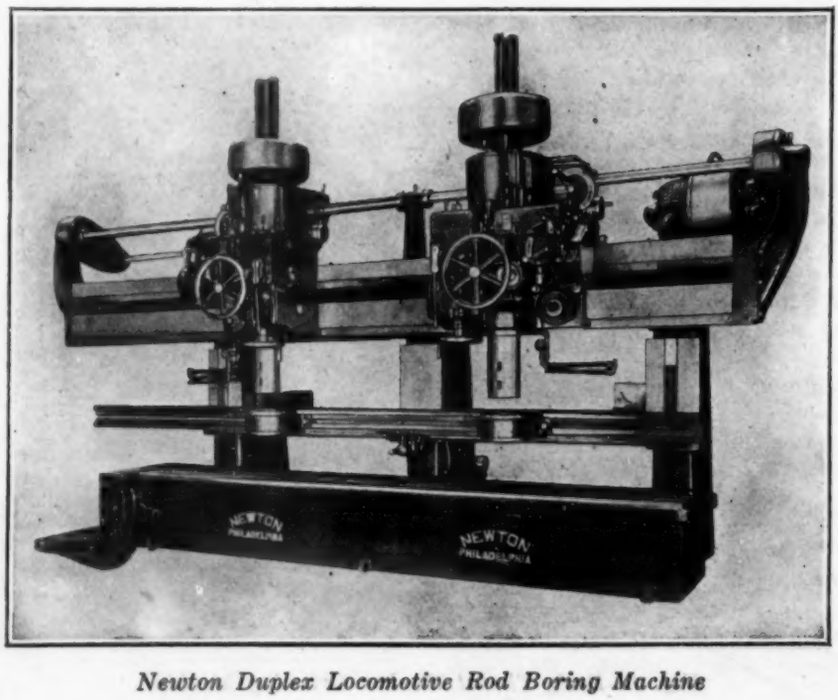
The feed change gear box is embodied in the sliding head and the feeds are controlled by a sliding key. The feed is transmitted to the spindle sleeve through a wide, heat-treated rack and pinion mechanism driven by worm gearing that is continually in mesh. An accurate automatic stop is used for setting to predetermined depths. The rapid approach and return handle is at the left of the operator.

The machine can be furnished for either belt or motor drive. When belt-driven, a wide-face pulley of the friction clutch type is furnished, and is controlled from the operator's position. When motor-driven, a 2-hp. motor is mounted on the base at the rear of the gear box, the drive from the motor also being controlled by a friction clutch. An all-geared positive tapping attachment is used in conjunction with the thread lead attachment, the latter being supplied for any desired pitch. A pump can also be furnished, together with a reservoir and pipe, and is arranged for belt drive from the first speed shaft.

Newton Duplex Locomotive Rod Boring Machine

The Newton Machine Tool Works of the Consolidated Machine Tool Corp. of America, Wilmington, Del., is now marketing an improved and redesigned model of its duplex locomotive rod boring machine. The standard machine has a plain table, but the machine illustrated also has an auxiliary drop-table attached at one end of the bed for machining the taper holes in crossheads.

The spindles are machined from open-hearth hammered steel forgings and have No. 7 Morse taper holes. Key and drift slots are provided, in addition to a face keyway for driv-



Newton Duplex Locomotive Rod Boring Machine

ing directly at the cutting point. The spindles are counterbalanced by ring counterweights suspended on chains. The spindle sleeves are fitted with bronze bushings and roller thrust bearings and provided with feed racks.

Each spindle is independently operated, being driven by a separate motor through back gears and a bronze spiral gear that meshes with a hardened steel pinion. When the machine is arranged for constant-speed motor drive a six-change gear box, in conjunction with a two-speed spindle head, provides twelve changes of speed. Six changes of feed are available and additional feeds can be obtained by the use of extra pick-off gears. In addition to hand adjustment and power down-feed to the spindles, power quick return is obtained through a metal cone friction. This friction is operated by the same lever that engages the feed.

The driving and feed gears are of steel or bronze, the essential gears being hardened and the whole mechanism being fully enclosed to run in oil. The saddles are 35½ in. in length and each is independently adjustable. They are securely clamped to the cross rail, taper gibs being provided to compensate for wear. A 1-in. pin extends 1 in. below the head and is located exactly on the center line of the spindle. This pin has a center line on it and is used to set the center distance between the spindles with the required accuracy.

The cross rail has a box section and is bolted and dowelled to three uprights. The uprights are fastened to each end and the center of the bed of the machine. An intermediate spindle support and a lower arbor support are included in the standard equipment of the machine. The intermediate support is an angle plate bolted and dowelled to the saddle and resting against the under side of the cross rail. When the spindle is positioned the support is clamped to the cross rail. The intermediate support shown in the illustration is a special design for the Pennsylvania railroad. Bearings that carry bushings with 8½-in. holes are fastened to the support and are adjustable vertically to suit varying heights of work.

The lower arbor supports consist of bushings with 3½-in. holes, fitted into a machined slot in the center of the table. These bushings provide supports for the lower ends of the boring bars and are adjustable throughout the entire length of the table.

The base and table is a box-section casting with a chip pan extending around both sides and the front. When the machine is equipped with a plain table it has a working surface 24 in. wide and 14 ft. long. The auxiliary work table, shown attached to the table in the accompanying illustration, is fitted to scraped bearings on the end of the base and has a 4-in. adjustment at right angles to the travel of the heads.

All operating parts, with the exception of the drive shaft at the top of the machine and the spindles, are fully enclosed. For driving by constant-speed motors, two 15-hp. motors, running at 900 r.p.m. are required. They are mounted on the rear of the gear boxes to which they are connected by gearing. When variable-speed motors are used they are attached to the tops of the end columns and are geared directly to the drive shaft.

Porter-Cable Double-Spindle Sander

For use in pattern and other woodworking shops the Porter-Cable Machine Co., N. Salina and Exchange Sts., Syracuse, N. Y., is now marketing a double-spindle sander. The

Porter-Cable Double-Spindle Sander

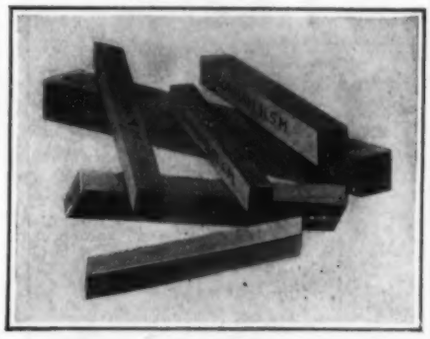
pedestal, head and motors of this machine are the same as furnished on the single-spindle model made by this company. The machine is designed to provide equipment for the surfacing of two radii on one machine in order to save time and labor.

The machine table is 24x50 in. in size and is held by its pedestal 38 in. from the floor. Each spindle is equipped with a ½-hp. G. E. motor that runs at 1,800 r.p.m. The right-hand spindle is ¾ in. in diameter and carries a fixed standard split roll 4 in. in diameter and 7½ in. long. The other spindle is ½ in. in diameter and changeable standard split rolls, 2 in. in diameter are used upon it. These rolls are 6 in. long.

The spindles are arranged to oscillate vertically as they revolve, the number of oscillations per min. being 60 and the vertical travel, 1⅛ in. The center distance between the spindles is 26 in. The motors are independent so that either spindle can be in use without running the other.

Gorham Ground Tool Bits

A line of tool bits has recently been placed on the market by the Gorham Tool Co., 2206 Twelfth St., Detroit, Mich. The bits are of high-



Gorham Ground Tool Bits

grade steel and of uniform hardness.

They are made from over-sized hot-rolled bars that are cut to standard lengths with a bevel on each end, and are ground to remove the scale and decarbonized surface of the annealed stock before being heat-treated. After heat-treating, the bits are again ground square and to size. The bits are made in sizes from ¼ in. to ⅝ in. square, and from 2½ to 5 in. long.

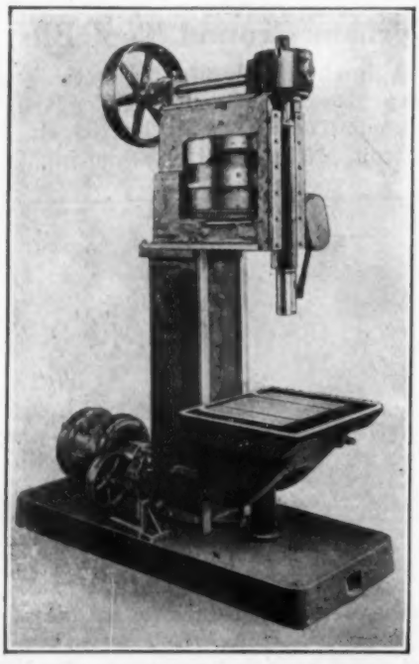
Eclipse Robinson Adjustable Center

The adjustable lathe center formerly manufactured by the Robinson Adjustable Center Co. is now being marketed by the Eclipse Interchangeable Counterbore Co., Detroit, Mich. The design of this device has not been changed by the present manufacturers but the method of manufacture has been improved.

The center was formerly hardened only on the outside, the hole for the insert being only drilled and reamed. The body of the center is now hardened and ground both on the inside and on the outside, the result being a device that is better able to resist wear.

Baker Bros. Cam-Feed Drilling and Boring Machine

Baker Brothers, Inc., Toledo, Ohio, are now marketing a cam-feed drilling and boring machine for rapid production work. The machine is designated No. 24, and is especially adapted for facing work since the cams can be designed to face to the required depth, then providing a long dwell during which the surface is entirely cleaned up. After this the spindle is quickly withdrawn. Intermittent drilling can also be done, the cam automatically giving a rapid advance between the holes that are to be bored or drilled.



Baker Bros. Cam-Feed Drilling and Boring Machine

Using a high-speed drill in solid steel, the single-spindle machine has sufficient capacity for 1½-in. holes, and a proportionate capacity for boring or multiple operations. The hole in the spindle is finished to a No. 4 Morse taper. The distance from the center of the spindle to the face of the lower frame is 10 inches.

The operator has both hands free for the removal and chucking of the work. Many pieces can be held in the hand between stops to keep them from revolving, so that the handling time for the work is small.

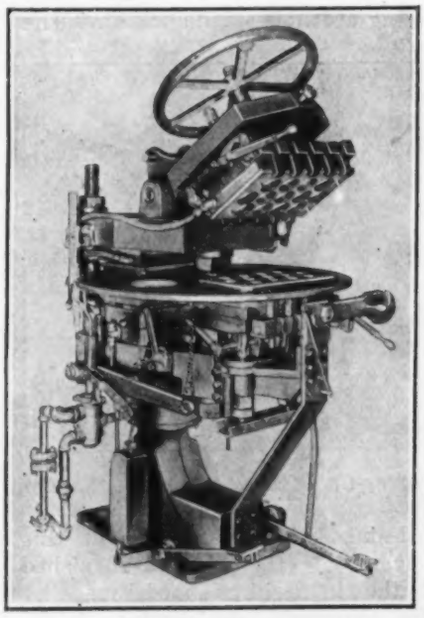
The mechanism of the machine is simple and contains alloy-steel, heat-treated gears. Ball bearings are used and the apparatus is designed to make the necessary maintenance expenditure for the machine as low as possible. The accompanying illustration shows a standard single-spindle machine, and a special two-spindle machine for boring connecting rods is also available.

The maximum distance from the end of the spindle to the table is 22 in. The size of the plain table is 15x16 in. Each machine is specially equipped to give the feeds and speeds required by the work to be done. One set of cams is furnished as standard equipment.

The machine can be arranged for either belt or motor drive. The floor space necessary for the belt-driven machine is 28x36 in., and the motor-driven style requires a 27x57-in. space. The height of the machine is 87 in., the belt-driven machine weighing 2,550 pounds.

"Duo-Press" Plastic Molding Machine

The Automatic Molding Press Co., 280 Passaic St., Newark, N. J., has just placed on the market a universal plastic molding machine, designated the "Duo-Press." This machine is designed to mold articles out of shellac, bakelite, celluloid or other plastic combinations. Either simple or complex forms of molds can be used.



"Duo-Press" Plastic Molding Machine

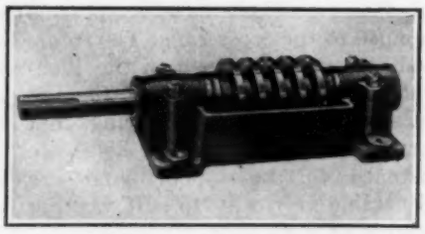
The mechanism of the machine and the arrangement of the parts make possible a great variety of combinations of temperature, pressure and time, so that the device is universal in its scope. A main pressing unit is mounted in combination with a sub-press for all preheating and prepressing. A mold gripping and separating press is also incorporated, together with a tilting-head mechanism for exposing the molds. The proper heating and cooling of the molds is provided by means of four chambered jackets and means for moving the lower mold plate and substituting ejector pins are embodied.

The machine has an automatic turntable for handling the molds. The main press has a capacity of 127 tons and is kept in constant action, since the separating, loading and unloading of one set of molds is done while a second set is under final pressure and curing. The automatic turntable simultaneously transposes the sets of molds and obviates the danger of damage to the molds and dies.

Jones Double-Thrust Worm Box

For use with open worm-gear drives where something less expensive than a completely enclosed unit must be used, the W. A. Jones Foundry & Machine Co., 4401 West Roosevelt Road, Chicago, Ill., has recently placed on the market the double-thrust worm box shown in the accompanying illustration.

The box is designed to give an accurate and rigid support for the worm shaft and holds a supply of oil in which the worm operates. Three finished thrust washers, one fiber and two of steel, are provided at each end of the worm. The bearings are babbitted, bored and faced on the ends. The boxes are made in standard sizes to suit standard steel worms made by this company.



Jones Double-Thrust Worm Box

News of the Week

Bright Industrial Future Is Pictured for Germany

Industrious Teutons are striving for economic "come-back"

By E. J. Mehren
Vice-President, The McGraw-Hill Co.

No country in the world today is, from the economic viewpoint, so interesting as Germany. She occupies the spotlight in Europe. What is to be her future?—is the question that everyone in the old world is asking.

The answer to that question no one can tell. The problem is complicated. But this even the casual visitor to Germany can say: Germany has made tremendous strides since the war; she is showing extraordinary recuperative power—against tremendous handicaps; she has worked a financial miracle since November of last year; and, finally, no nation that shows Germany's potential strength can be permanently kept down, can be crushed.

The situation is in sharp contrast to what one expects. In America we hear of the wrecking of the currency, of the sufferings of last winter, of the difficulties under which her industries labor in securing raw materials and finding markets. Upon these reports—which, of course, are correct—we paint with our imaginations a country on the verge of despair, a disrupted industry, a tottering government. The surprise is a great one—and, if one is fair-minded, he must come away with deep admiration for what has been accomplished.

Let us briefly paint the picture of Germany's economic circumstances:

Under the Versailles treaty, or as a result of it, she lost heavily of her iron and coal deposits—in Alsace-Lorraine, the Sarr and Upper Silesia; she lost her colonies, her foreign investments, her shipping, her export organization and its connections; she has a large part of her territory under the control of her former enemies. In addition she has been through an exhausting war and a political revolution.

Four Years Ago and Now

These conditions are not new; they existed when I was in Germany just four years ago, in the summer of 1920. The result was what might been expected—an under-fed, discontented people, a disorganized industry and an all-pervading discouragement, unrelieved by any ray of hope.

Since then, since 1920, two other financial disasters have forced themselves into the picture—the occupation of the great industrial district of the Ruhr, and the wrecking of the currency.

With these added calamities one should logically expect that conditions would be worse instead of better, that the despair would be even blacker than before.

And yet conditions are as I have described—immeasurably better. Here is a nation on the up-grade, rather than the down. Here is a nation to be reckoned with economically, not to be ignored; here is a nation that is sure to be an important factor in the world's industry.

Economic Handicaps

Let it be clearly understood that the path of recovery for Germany is not an easy or a quick one. She is not out of difficulty. The economic handicaps recited above are still upon her; some of them are being slowly removed—such as the absence of shipping and foreign commercial connections; some of them—such as the lack of colonies—may never be removed. But a nation that under present handicaps has recovered as she had done will rise despite the obstacles that a commercially-minded world is likely permanently to place upon her.

The great German economic miracle was wrought in the closing months of 1923 and the early part of 1924. Early last autumn Germany truly—to use the words of Basil Miles, administrative commissioner for the United States in the International Chamber of Commerce—was at the cross roads. Directly ahead—on the road she was traveling, the road of unbalanced budgets, of state subsidy of the railroads, of currency debasement—was revolution, industrial suicide, destruction. To the right was a stormy path, extremely difficult, beset possibly by disorder, possibly by revolution, but leading, if the difficulties could be mastered, to economic soundness. It was the road of a stabilized currency, with its accompaniments of balanced budgets and governmental economy. Germany chose to go to the right, to take the difficult road, to bear the stress of financial reform and currency stabilization. She did it at a time, too, when the situation in the Ruhr was at its most critical stage, when strong forces were seeking to pry loose the Rhineland and erect it into an independent state, when the attitude of Bavaria toward the rest of Germany was much in doubt. But she went on nevertheless.

The government declared that the mark should be stabilized at four trillion 200 billion to the dollar. There was a severe contest with the mark speculators, but by severe measures the government won, and since November, 1923, legally, and about January 1, actually, the rentenmark has stood at 23.8 cents to the dollar. There was no revolution.

That achievement marked the turn. It showed the return of administrative strength in the German government. It restored business to a sound basis. It killed speculation and the orgy of spending. It restored the incentive to save and therefore to work. It marked the end of the crisis in the economic and social disease and the beginning of recovery.

Germany is beyond the cross roads and has chosen rightly. The future is long and difficult, but there is health where there was disease, there is hope where there was despair.

Let me now add some details—briefly. They will help to an understanding of the situation. Each item deserves elaboration, but that would take much space.

The severest present industrial handicap is lack of credit. The great credit reservoirs were nearly or entirely wiped out by the fall of the mark. Further, there was no incentive to save; industries and individuals converted the tobogganing mark into goods as quickly as possible. Today the credit resources of the banks are estimated at one-tenth the pre-war amount. When credits are obtained the interest rate is 2½ per cent per month for the very best security.

Lack of Capital

There is a terrific money shortage, which also curtails business, for with lack of credit everyone tries to insist on cash on delivery.

Wages are at approximately pre-war level. Prices, as of July 15, (according to the "Frankfurter Zeitung" index, the highest index I could find and which takes in 98 commodities) are 34 per cent above 1913. (The government's index for wholesale prices is 12 per cent above 1913.)

Efficiency of labor has increased notably and is still increasing. I heard no general complaint against the working man in Germany as I did in England.

Unemployment, while fairly large just now, is not as great as that of Great Britain, and does not present the all-engrossing problem in Germany that it does in the British Isles.

The works councils, elected by the workers, are said by the employers to be a good influence.

Robert T. Kent Appointed Superintendent of N. Y. Prison Industries

Noted management engineer chosen for newly created office

Superintendent of Prisons James L. Long announced recently the appointment of Robert Thurston Kent, a well-known New York production and management engineer, to the newly created position of Superintendent of Prison Industries at a salary of $7,500 per year. This appointment is made with the advice and consent of Governor Smith as provided in the new prison law. The appointment becomes effective on August 20, when Mr. Kent will return from the Prague International Management Congress which was held under the auspices of the Czechoslovakian government. Mr. Kent is representing the American Engineering Council at this Congress.

MR. KENT'S ACCOMPLISHMENTS

Robert Thurston Kent graduated from Stevens Institute of Technology in 1902 with the degree of Mechanical Engineer. Prior to entering college he served an apprenticeship in the machinist trade and earned journeyman's wages as a machinist. Immediately after graduation he worked for a while as a journeyman iron worker, later becoming foreman in charge of construction work. He became connected with a firm of heating and ventilating engineers and later joined the engineering staff of the Link Belt Co. in Philadelphia. He was for four years editor of the *Iron Trade Review*, in Cleveland. Since 1912 he has engaged in consulting practice, first in the steam engineering field and later in the shop practice and management fields. This work covered improvement of methods in factories of various kinds, reorganization of shop personnel and routine to effect greater production and decrease costs. Industries in which work was done include manufacture of machine tools, fire-proof and burglar, proof vaults and safes, fine stationery, handkerchief, braiding machinery, toys, hydraulic equipment. In this connection he became associated with the late Frederick W. Taylor and did considerable work on the analysis of time study for him. At the outbreak of the war he was appointed chief engineer of Mayer, Morrison & Co., consulting engineers, and in this connection he supervised the organization and production of some of the largest metal-working plants in the United States.

His consulting practice covered all phases of business and production management, including purchasing, sales, finance and factory operation. Some of the work included directing activities of plants employing upwards of 3,000 men. Actual shop positions he held prior to the beginning of the consulting practice outside of journeyman mechanic were foreman, superintendent and manager.

Upon the death of William Kent he succeeded to the position of editor-in-chief of the Mechanical Engineers' Handbook, a book in universal use by engineers and production managers, and three years age began the preparation of the tenth edition of this well known work which has just been completed.

E. C. Henn Meets Tragic Death

Edwin Charles Henn, one of the best known men in the machine tool industry and a director of the National Acme Co., Cleveland, was instantly killed at Painesville, Ohio, Wednesday

Edwin C. Henn

Aug. 20 when a Nickel Plate R.R. express train struck and demolished the touring car in which he was riding. Mr. Henn was accompanied by O. A. Smith of Cleveland who was the experimental engineer of the National Acme Co. Mr. Smith was also fatally wounded and died while being taken to a hospital.

The two men were on their way to Warren, Pa., on a business trip and Mr. Henn was driving the car.

Mr. Henn was 62 years of age and had been actively engaged in the metal industry since before he was 18 years of age. After a grammar school education in New Britain, Conn., where he was born, he went to work with Landers, Frary & Clark. Later he was with the William Powell & Houston Co., Cincinnati, Ohio, and still later he returned to New England and joined the organization of the Pratt & Cady Co. at Hartford. He remained with this company for 18 years and then with Pratt & Whitney for a short time.

After his experiences with these companies Mr. Henn bought a half interest in the Standard Manufacturing Co., Hartford, Conn., and it was while this company was struggling that he invented the first Acme multiple spindle automatic which was the pioneer multiple-spindle screw machine.

In 1901 together with his brother, A. W. Henn, the business then known as the Acme Machine Screw Co. was moved to Cleveland and later joined with the National Manufacturing Co. and incorporated as the National Acme Co. Plants were later established at Windsor, Vt. and Montreal, Canada.

Mr. Henn was prominent in Cleveland civic activities. He was elected president of the Cleveland Athletic Club last January and was a member of the Cleveland Engineering Society, the Chamber of Commerce, the Union Club, the Colonial Club, Shaker Heights Country Club, and was formerly on the board of governors of the American Plan Association.

Last fall he resigned as general superintendent of the National Acme Co. and was succeeded in this position by one of his sons, Oliver L. Henn. Mr. Henn is survived by eight children.

Oscar Smith Long Associated with Mr. Henn

Oscar A. Smith was born Sept. 9, 1872, at New Britain, Conn. He received his apprenticeship in the machine trade in Hartford, Conn., at the Johns Pratt Co. plant.

In 1896 or 1897 he joined E. C. Henn, who at that time was experimenting with a multiple spindle automatic screw machine. Since that time he has been directly associated with Mr. Henn all through his life.

Oscar A. Smith

In addition to this experimental work Mr. Smith has also been connected with the National Acme Co. in numerous executive capacities. At the time of his death he was superintendent of the screw products division of that company.

British Science Association Holds Its Annual Meeting in Toronto

Many engineering subjects discussed in sectional meetings

For the second time in its history, the British Association for the Advancement of Science selected Toronto, Canada, for its annual convention which took place from Aug. 6 to 13, inclusive. Incidently, it was the fourth visit of the association to the Dominion, the first being to Montreal in 1884, the second to Toronto in 1897, and the third to Winnipeg in 1909.

Upwards of 2,500 members including some of the world's most distinguished scientists registered attendance for the meetings of the thirteen sections of the association.

The business session commenced at noon on Wednesday, but the real work of the convention was officially begun at the Inaugural meeting in Convocation Hall of the University, by Major-General Sir David Bruce, who, on assuming the presidency of the association in succession to Prof. Sir Ernest Rutherford, delivered the presidential address; "Prevention of Disease."

Other and important papers read, of interest to the engineering and industrial world, are as follows, the first three being sectional presidential addresses:

"Chemistry and the State," by Sir Robert Robertson; "A Retrospect of Free Trade Doctrine," by Sir William Ashley, vice-principal of the University of Birmingham; "A Hundred Years of Electrical Engineering," by Prof. G. W. O. Howe, professor of electrical engineering at the University of Glasgow; "On Business Forecasting" by Prof. W. N. Persons and R. H. Coats; "The Economic Outlook in Great Britain" by Prof. A. L. Bowley; "Evidence for the Existence of an Endurance Limit in Metals and its Determination," by Profs. H. S. Moore and T. M. Jasper; "The Work of the Fatigue Panel of the Aeronautical Research Committee," by Prof. C. F. Jenkin; "Unemployment Prevention and Insurance," by Prof. J. R. Commons and Bryce R. Stewart, the latter paper being followed by a discussion on the subject.

Subjects Discussed Cover Wide Field

"Effect of High Temperature on Range of Repetition Stress," by Prof. F. C. Lea; "Some Comparative Fatigue Tests," by H. F. Gough and H. J. Tapsell; "Torsion Fatigue Hysteresis," by C. E. Stromeyer; "Measurement of Quenching Stresses in Steel," by Prof. H. P. Philpot; "Reverie and Industrial Fatigue," by Dr. E. Mayo; "Cobalt Magnet Steels," by E. A. Watson; "The Large Deflection of Circular Plates," by Prof. S. Timoschenko; and "Some Recent Photo-Elastic Investigations by Means of the Coker Method in the United States," by Prof. Gilbert Cook of the Massachusetts Institute of Technology. R. S. Whipple gave an illustrated description of some new instruments, including a new torsion meter, vibrograph and accelerometer.

The Committee of Section (G) submitted as its report "On Certain of the More Complex Stress Distributions in Engineering Materials" the following eight papers: "Photo-Elastic Methods of Testing," by Prof. E. G. Coker; "A Standard Form of Test-Piece," by Prof. W. E. Dalby; "The Impressed Conditions of Fatigue Tests," by A. A. Griffith; "The Influence of Circular Holes on the Fatigue Strength of Hard Steel Plates," by Prof. B. P. Haigh and Albert Beale; "Note on the Distribution of Stress in Fatigue Test-Specimens, Torsion and Bending," by Prof. W. Mason; "Note on Impact Experiments," by R. V. Southwell, and two papers by Prof. Andrew Robertson entitled, "The Effects of Inaccuracy of Axial Loading," and "On the Drop of Stress at the Yield Point of Ductile Materials."

The citizens of Toronto were invited to evening lectures on "The Influence of Metallurgy on Social Life," by Sir Henry Fowler; "The Control of Growth," by Prof. Julian S. Huxley; "Einstein's Theory of Relativity," by Prof. A. S. Eddington; and "Explosives," by Sir Robert Robertson.

Several excursions around Toronto, Niagara Falls and Guelph, of sectional interest were arranged.

Peru Proves Remarkable Machinery Market

American machinery exports to Peru showed a gain of 68 per cent in 1923, increasing from $1,179,748 in 1922 to $1,981,251 last year, according to the Industrial Machinery Division of the Department of Commerce, and her growing importance as a market for American machinery is shown by the consistent gain in position among machinery markets of the world—twenty-first in 1910 and fourteenth place in 1923. Principal increases during 1923 took place in exports of mining, oil-well, and pumping machinery, comparative prices for the two years showing a difference of nearly $450,000, and construction and conveying machinery increased, values totalling about $62,000.

Peru now outranks British South Africa and Spain, and absorbed only $150,000 less worth of machinery from the United States than the Philippines.

Recent developments in the oil fields of Peru have caused an increased demand for oil-well machinery. A similar demand has been noted for mining and quarrying machinery. Rock drills, ore crushing, and ore sorting machinery exports showed considerable gains according to 1923 figures, while copper smelting and refining was undertaken on a larger scale in Peru during that year.

Exports of sugar-mill machinery nearly doubled in 1923 over the preceding year. The cotton industry also showed development as reflected by increased shipments of American cotton gins and parts. Sugar mill machinery purchases from the United States increased from $66,445 in 1922 to $211,339 in 1923, and American exports of cotton gins nearly doubled in 1923.

Extensive harbor improvements are now being planned in Peru in addition to projects of this character already under way, calling for increased amounts of construction machinery. Road-making machinery has been purchased in increased amounts, a program of public road works having been undertaken by the government during the year. The increased demand for construction and conveying machinery is shown by United States customs figures, showing that exports of these types of machinery more than doubled in 1923 over the preceding year.

Solenoid Chronograph Is Perfected

The Technical division of the Ordnance Department of the Army has perfected after four years work, a solenoid chronograph. With it accurate measurements are made of the muzzle velocity of each projectile fired. In the use of this instrument the projectile is magnetized before firing. It then is discharged through two coils of wire hung up in front of the gun at a known distance apart. The current produced by the passage of the projectile operates the instrument which measures the velocity. Research work at Aberdeen is being carried forward on a large scale. During July more rounds were fired from cannons than for any other month, save three, since July 1, 1919. The total number of rounds was 4,399. In addition to this in the course of the research work 6,092 rounds were fired from small arms, while 60 bombs were tested and 13 airplane flares were tried out. In the course of research work on automotive material 1,200 miles were run.

Work at Watertown

The technical division, however, does not confine its research to the establishment at Aberdeen. At the Watertown Arsenal, for instance, very promising progress is being made in the use of x-rays to detect physical defects in steel. By this method cavities, blowholes and other defects are revealed thereby raising the factor of reliability on parts relied upon for vital duty.

Various types of automotive equipment recently have been subjected to tests under service conditions by round trip march between Fort Benning and Fort Pragg. Nearly 1,000 miles were covered, during which a most minute check was kept upon the performance of the automotive units.

Just at this time the technical division is paying very close attention to studies of the ballistics of bombs. Through camera improvements it is now possible to make much more accurate observations of bombs dropped from airplanes. Another interesting experiment now in progress is on guns without recoil devices which permit study of the effect of laws governing inertia.

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry based on current developments

By Theodore H. Price
Editor, *Commerce and Finance*, New York

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THE price of the milk supplied to Greater New York was raised one cent a quart last week. As the city consumes about three million quarts a day this means an addition of over $10,000,000 a year to the cost of living in the metropolis. But it may also mean that those who use milk will buy less or that they will do without something else that they need less.

This advance in the price of milk which has attracted but little attention is cited as an instance of the effect that advancing prices have upon business in general. We all feel good when the prices of what we have to sell go up, but sooner or later an advance in the cost of the things that are necessary will compel us to do without the things that are unnecessary.

Conditions in the industrial field are also perplexing. An improvement in the demand for steel is still predicted, but it is slow in arriving.

With a few exceptions the cotton mills that were closed remain closed and the manufacturers insist that there is no money in the business. There is some increase in unemployment; in the building trades the supply of skilled labor is in excess of the demand.

In the security markets an easier tone has also been noticeable. No general decline has taken place and some stocks are higher, but bonds have ceased to advance.

The German loan is now expected early in October. The gossip is that it will be offered on an 8 per cent basis. The dealers are probably clearing their shelves for it and money is just a shade higher for both call and demand funds.

The Federal Reserve Statement does not show any significant change from last week, but the member banks report some increase in loans and good judges think that we have seen the lowest interest rates for some time. In this view I concur and advise legitimate borrowers to secure their prospective requirements as far ahead as possible.

In the main the news from abroad is satisfactory and Europe seems to be rapidly recovering her poise. Foreign exchange continues firm and London advices say that the Bank of England will continue to maintain the discount rate at a level that will attract enough gold to insure the resumption of specie payment. This makes it unlikely that the United States will continue to import gold in quantity.

Distributive trade in the United States is always quiet in August and this year is no exception. But there has been a fair demand for some cotton and woolen specialties, and most dealers are expecting a better business as soon as the vacation season is over. But whether there can be any increase over last year is a question.

The national income is no larger. The agricultural group will have more, but the industrial workers have less, for many of them have now been out of work a long time. An increase in the aggregate of our national purchases is therefore doubtful and reliance upon it may be a mistake.

But to the foregoing generalizations there are a few exceptions. One is coal. For many reasons the winter's supply of coal ought to be contracted for now.

Another is ocean freight. Those whose business involves the purchase of freight room or ship chartering ought to take advantage of the present low rates as a great increase in the world's maritime trade seems probable as soon as Europe gets back to work.

Of the political possibilities that may influence business in the United States it can only be said that in the East there is less fear that the election of a President will be thrown into the House of Representatives.

As this review aims to be nonpartisan no effort is made to explain why there is increased confidence that one of the regular nominees will have a majority in the electoral college. But if this confidence becomes nation-wide rather than regional the effect will be salutary for it is coming to be generally felt that with either Mr. Coolidge or Mr. Davis as President, the economic interests of the country will be safe.

What's Doing in Industry

Better business seems to be just ahead in the machinery and machine tool business in the various centers of the United States, and builders and dealers alike are optimistically awaiting its arrival. There were slight improvements recorded during the past week and sales were made to general industries, the railroads and also to automobile makers in sufficient volume to cause encouragement. Inquiries would indicate that the middle of September will see the return of business to somewhere near that enjoyed in the spring.

General business is also better in all parts of the country and reports from the larger industries are all indicative of improvement. Steel orders have gained materially and automobile production has been slightly increased with dealers reporting better sales.

Large business interests are looking toward Europe and the adoption of the Dawes plan, hoping that this will open up fields long dormant and that next year will bring exporting figures to new high levels.

Railroads and railroad consolidations have occupied the attentions of industrialists, but further than being a good economic move no improvement is expected to machinery or machine tool builders.

Wall Street has shown further strength during the week, although profit taking among the speculators caused upsets in the general upward trend. U. S. Steel reached a new high of 111, but dropped off later. Several motor shares were favorites, and Mack Trucks, Inc., showed additional strength upon the announcement of further expansions and a new stock issue of about four and a half million.

C., I. & W. Railway Buys Car Repair Shops

Announcement has been made of the purchase of the Hammond & Jeffers car repair shops at Brazil, Ind., by the Cincinnati, Indianapolis & Western Railway Co. The Hammond & Jeffers shops were located at Brazil shortly after the C., I. & W. purchased the Southern section of the C. & E. I., two years ago. The shops were installed in the C., I. & W. yards and have been operated most of the time since. The officials say new machinery and equipment is to be installed at once and the force of men will be increased. G. O. Burton, who has been manager of the shops for the Hammond & Jeffers Co., will go to Cleveland where he is to be the representative of the General Equipment Company of New York City. The round house and facilities there had been leased by Hammond & Jeffers, he said, and were purchased by the C., I. & W. to supplement the heavier car repair work done at the Indianapolis yards.

The Industrial Review

Progress of the machinery and machine-tool business in various parts of the country

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

Canada

Further signs of improvement in the metal markets of Canada are found in reports of increased sales in many industrial centres. The Canadian Drawn Steel Co., Hamilton, has been working entirely on orders during the last two weeks, whereas for the two months previous the concern's production was solely for stock. Similar conditions are reported in Toronto and Montreal. Dealers in machinery and machine tools report a fairly steady demand and are looking forward optimistically to an active trade this fall. Inquiries from the railroads are more prevalent and considerable business is expected from this source during the next two or three months. There is very little change in the old material markets but dealers contend that the satisfactory settlement of the London reparations conference will develop sentiment into action and an appreciable advance in prices is predicted.

A branch of the automotive industry which is proving extremely remunerative to Canada is the production and sale of freight automobiles and trucks. A report just issued by the Dominion Bureau of Statistics shows that during the twelve months ended June, 1924, Canada exported 15,475 motor trucks as against 5,712 during the preceding twelve month period.

Automotive and implement interests of eastern Canada are watching the Western crop situation carefully. Since the farmer of the West has been doing without luxuries and extras during the past two or three years and since stocks in many lines are low, it is expected the sale of the crop will be the signal for an increased buying movement within the next few weeks.

Milwaukee

Aggregate sales of metal working equipment during August generally are reported to have exceeded the total for July, and represented a slight improvement over June business, but similarly to the preceding months since Jan. 1, fell below the quantity in corresponding months in 1923. It has been established that the general situation is on the way toward definite improvement, and the local trade breathes more freely when contemplating fall and winter trade than it did early last spring, when a declining movement in sales was making its appearance.

More noticeable in the better demand for equipment is the call for special machines, accepted as an indication of the growing desire of manufacturers to acquire higher efficiency at minimum cost by replacing tools of older design. Manufacturers of equipment have been anticipating this tendency, for which they are largely responsible, but naturally it is not possible to standardize highly developed designs or build in quantity because almost every requirement embraces special types. However, the development of fixtures of manifold purpose to make more or less standard types meet special needs, in many cases is making unnecessary the costly production of special machines in every instance.

Dealers comment favorably on the used machinery situation. The supply of such equipment is probably larger than usual, but it is not now being constantly augmented, as throughout most of the past year or two. In this territory, financial difficulties among users of metalworking equipment are appreciably lessened, and for some time past no large quantities or lots of used machinery have been thrown on the market through liquidations of various kinds.

Due to the steady betterment in the automobile industry, those Milwaukee foundries, machine shops and manufacturers doing a large business in this particular field, are winding up the month of August with a better feeling than immediate and future prospects could arouse at the close of any month since February.

Detroit

Noticeable improvement in industrial conditions in Detroit and its environs is leading leaders in the machine tool and machinery fields to look to the immediate future with more confidence than has characterized their views for the past few weeks.

Strength is added to this belief through a survey of local firms which shows that July was one of the best months for sales of machinery that 1924 has witnessed, while August is holding its own with previous years.

Sales remain rather scattered, with inquiries fewer than ordinarily. This is at least compensated by the fact that a larger proportion of inquiries are resulting in sales. Several of the larger dealers report considerable activity in the replacement line in the automobile and allied plants.

The slowly gaining momentum of the automotive business is everywhere evident, the number of companies holding production down to permit sales to absorb stocks is rapidly decreasing, while the number of those in the category of increasing the output is growing. The rank and file are turning out cars in proportion to actual orders, but many of these are slowly but consistently increasing their plant forces. This gradual turn toward more activity in the manufacturing end of the motor business is reflected in the inquiries and orders being received by representatives of steel mills here.

Agents for all manner of automobile materials and supplies note a picking up in demand. One of the largest suppliers of aluminum ingots and aluminum castings declares that within the last week there has been experienced an increase in orders from 90 per cent of their customers.

Employment figures are remaining at about their level for the past three weeks, with a slight trend toward longer hours, the first step in the gradual resumption of normal production in the automotive field.

Southern District

While the reports of dealers relative to machinery and tool sales in the Southeast during the past fortnight show conditions to still have a rather spotty tendency, sales as a whole have been quite satisfactory among the larger distributors, and more or less optimism is prevalent, especially as regards the outlook for the future.

The volume of business has continued to run somewhat better than during the corresponding period of last year, a rather unusual condition, because in many other lines of business trade has proved less brisk than in 1923. Most of the machine tool shops and factories are running on a fairly steady basis, with quite a bit of improvement shown in production the past month.

In the lumber industries, for instance, production is the largest in several months, and mills are doing considerable buying of equipment. The same is true of the furniture and similar woodworking industries in the Carolinas. Sales of machinery to the lumber and woodworking industries, therefore, have been the best during the past four weeks in a number of months, and promise to continue on this same basis.

Textile industries also are showing signs of greater activity, with textile mill shares in the heaviest demand since the early part of this year, which is an excellent barometer as to the near future outlook. Machinery inquiries from this source are picking up steadily, and are beginning to develop a fair volume of business. Sales, in fact, are described by the trade as better now than they have been at any time this summer.

Demand for heavier equipment from railroads still continues fairly active, though not as great as three or four months ago. However, August sales bid fair to prove somewhat better than August of last year, as there is still considerable shop and terminal construction in progress by the larger

railroads in various parts of the South. The Southern announced this month a $750,000 project for Atlanta, including principally locomotive shops. They are to be equipped with machinery of the latest design, largely replacing the former equipment in the old shops. This is in addition to a $3,500,000 terminal and shop project which the same company is carrying out at Knoxville, Tenn.

New York

Somes sales of machinery and machine tools have been reported in the New York district this week and a better tone is given to the market by most dealers. Railroad buying was evident with the New York Central and the Lehigh Valley railroads both inquiring for tools and with some sales consummated.

Buying for the Shibaura Engineering Co. by Mitsui & Co. continued during the week with Niles-Bement-Pond receiving the largest single order yet placed. The order was for planers and some other tools and is estimated at about $100,000. The total purchasing for this Japanese concern has so far amounted to about half a million dollars and further orders may still be placed for small tools.

It is expected that a new list for the Japanese government will be out during the coming week, and that orders will be placed shortly thereafter.

Rumors of improvement in the automobile parts and accessories plants have set machine tool dealers to work on these prospects and one Eastern automobile maker is reported buying tools.

All machinery and machine tool manufacturers are watching closely the outcome of the new bus merger in New York city which would mean large orders for bus makers in the East.

Used tools sold well during the past week.

Exports improved in all lines according to the exporters, and August will show a good record of tools sold.

Cincinnati

The Cincinnati machine tool houses are operating at the present time at about forty per cent of their normal capacity. The mid-summer quiet as well as the general industrial slump has been felt by local plants, but executives express the opinion that there will be a change for the better in the early fall. Orders have been spotty with sales fluctuating to a great extent. Automobile manufacturers have been showing caution in their buying and are only placing business when necessity demands. Little change is expected from this source in the next few weeks. Railroads have also been feeling their way and have not been in the market lately to any noticeable degree. Some shop tools have been purchased, but otherwise the railroads have been inclined to go along with their present equipment. Purchases in the general industrial field have been limited to immediate needs. Inquiries are coming in in fair numbers and indications point to local concerns booking good business next month.

Lathe and milling machine manufacturers state that their production has been on about the same scale as during July. They are operating on a reduced schedule for the present. There have been good inquiries, however, and executives believe that there will be an increase in output in September. Planers are in fair demand and manufacturers feel gratified at the outlook for the early fall season. There has been limited production of drilling machinery here. Electrical tool firms report that their business has been about normal for this time of the year. Production of woodworking machinery is going forward nicely with orders coming in daily from all parts of the country. One of the large woodworking machinery houses in Cincinnati reports that 1924 will probably be the biggest year in its history. Conveying machinery manufacturers are also operating on a satisfactory basis. Laundry machinery plants are working on a normal production schedule and are pleased with the volume of business that they are securing.

Cincinnati foundries are operating part time or with reduced forces. This condition is expected to continue for the next few weeks when an increase in production is anticipated. Unemployment in Cincinnati has passed the peak stage and there are less men out of work than there were a short time ago. Both skilled and unskilled men are not quite as plentiful as they were.

Indianapolis

More optimism is expressed in Indianapolis in regard to the future of the machine tool and metal working machinery trade. This optimism is caused by increases in business during the last two weeks and also by the large number of inquiries that is being received. Virtually all lines are increasing their orders, both for tools and machinery. The manufacturers here who do a national business in tools and machinery say the East has reacted more quickly to favorable conditions than the West, but the entire situation is very promising.

Inquiries from the furniture factories for special woodworking machinery is good and some business already has resulted from the increase in orders at these plants. From all indications these plants will get more and more in the market as fall begins. Reports show the volume of orders they are receiving is growing steadily and most of them have increased their production schedules. This is surprising in view of the fact that the volume of business done at the mid-summer furniture shows was very disappointing.

Demand for tools is beginning with the automobile factories. The last week has seen a noticeable increase both here and at South Bend, Kokomo and Connersville. It is predicted that production in these plants will be much larger this fall than it was a year ago.

Officials of E. C. Atkins & Co., say the lumber machinery business continues good and they are looking for much more business before winter hampers operations. Mills are behind with orders, they say, and production is being rushed.

Personals

FRANCIS H. GRIFFITHS succeeds W. R. Bassick as president and general manager of the Turner & Seymour Manufacturing Co., Torrington, Conn., having been elected by the directors at the meeting held Thursday, Aug. 21. Mr. Bassick is arranging to take an extended tour, but further than that has no plans.

LOUIS E. GUTTZEIT is now Chicago district manager for the Latrobe Electric Steel Co., Latrobe, Pa. Mr. Guttzeit was forme ly manager of the Detroit district for the same company.

HORACE S. MEESE has been made general sales manager of the Commercial Truck Co., Philadelphia. He was formerly transportation engineer with the same company.

WALTER J. BAUMGARTNER, formerly chief engineer with the Garford Motor Truck Co., Lima, Ohio, is now advisory engineer.

FRANK L. HAMBY has sailed for Europe where he will represent the Nordyke & Marmon Co., Indianapolis, Ind.

H. R. FORBES is the Eastern representative of the Lumen Bearing Co., Buffalo. His headquarters are at 50 Church St., New York City.

P. H. SACKETT will represent the Pawling & Harnischfeger Co., Milwaukee, Wis., in the Minnesota-North and South Dakota district. His headquarters will be at 3,445 Hennepin Ave., Minneapolis, Minn.

F. H. SMITH is now in charge of the Cleveland office of the Southwark Foundry & Machine Co., Philadelphia.

JOHN G. BOYD, for fifteen years superintendent of the railway shops at South Devon, New Brunswick, has retired.

R. F. SIMPSON, formerly purchasing agent of Sawyer Massey Co., Hamilton, Ont., has been appointed western Ontario representative of Canada Foundries & Forgings, Ltd.

DWIGHT T. FARNHAM, consulting engineer, 347 Madison Ave., New York City, will hereafter be associated with Marwick, Mitchell & Co., 40 Exchange Place, New York City. Mr. Farnham will continue his consulting practice.

G. KELWAY, who has long been associated with the firm, has been appointed manager of the Edgwick Works of Alfred Herbert, Ltd., Coventry.

M. C. MACDOUGALL of Osage, Iowa, has been sent by the Hart-Parr Co., Charles City, Iowa, to open a branch office in Melbourne, Australia. Mr. MacDougall has spent several months in Australia and has recently returned for his family and will sail in a few days of Australia. He will be there two years.

F. J. DE LIMA has been appointed representative for the Gibb Instrument Co., Bay City, Mich., in the Dominion of Canada. His headquarters will be in the Keefer Building, Montreal.

GORDON H. MCCRAE, manager of the London office of the Independent Pneumatic Tool Co., Chicago, has been elected a vice-president of the company.

NEIL KING and R. H. ALKEMA, formerly with the Vonnegut Machinery Co., Indianapolis, Ind., are now with the sales force of the Richey-Rhynearson Machinery Co., Indianapolis.

STANLEY C. WILSON has severed his connection with the J. C. Wilson Co., Detroit manufacture of Wilson motor trucks. He was secretary and treasurer as well as general manager of the company. Mr. Wilson has announced no plans for his future activities.

WALTER A. KYSOR, formerly president and general manager of the Acme Motor Truck Co., of Cadillac, Mich., has established the Kysor Heater Co., which will be located at Allegan, Mich.

EDWARD H. BAIR, formerly associated with the Kidwell Boiler Co. of Milwaukee, has resigned to engage in business as a manufacturers' representative and sales engineer, with headquarters at 1143 Wells Building, Milwaukee. He will represent the Permutit Co., Combustion Fuel Oil Burner Co., Audiffren Refrigerating Machine Co. and also the Autovent Fan & Blower Co.

Business Items

The United Machine & Manufacturing Co., Canton, Ohio, has been purchased by the Sanford Riley Stoker Co., Worcester, Mass. The plant will be continued in Canton under the name of the Sanford Riley Stoker Co.

The Consolidated Machine Tool Corp. of America announces the removal of the Colburn Machine Tool Works from Cleveland to its Betts Machine Works in Rochester.

The Formica Insulating Co., Cincinnati, Ohio, has increased its factory space to take care of increased radio business.

The D. McKenzie Machinery Co., Ltd., has been granted federal incorporation in Canada with a capital of $100,000. The principal incorporator is Daniel McKenzie and the headquarters of the company will be in Guelph, Ontario.

The Philadelphia Gear Works has moved its office to Richmond and Tioga Sts., Philadelphia.

Clyde J. Bath & Co., Cleveland, Ohio, will have charge of the sale of the machine tools and machinery of the Sharon Pressed Steel Co., having been appointed by the Midland Bank, which is the trustee for the company.

The Oilgear Co. has moved into its newer and larger quarters, 655-667 Park St., Milwaukee, Wis.

The Fuerst-Friedman Co., Cleveland, has moved to its new quarters, East 53rd St. and Hamilton St.

The Grant Gear Works has moved into its new factory at Second and B Sts., Boston.

The Electric Welding Supply & Sales Co., Inc., 45 L St., South Boston, Mass., has been incorporated under the laws of Massachusetts and has taken over the business heretofore conducted by the Electric Welding Supply & Sales Co. of 239 Franklin St., Boston. The officers of the new company are: C. W. Hill, president; B. J. Connelly, treasurer; and M. G. Hill, secretary.

The American Engineering Co., of Philadelphia, announces the following representatives for the sale of its products: H. D. Betts, 406 S. Franklin St., Syracuse; the C. F. Bullotti Machinery Co., 67-71 Main St., San Francisco; A. G. Cary, 410 Endicott Bldg., St. Paul; Chatard & Norris, 206 Water St., Baltimore; Colwell & McMullin, Park Square Bldg., Boston; the Coon-DeVisser Co., 1772 W. Lafayette Blvd., Detroit; H. D. Conkey & Co., 605 Chamber of Commerce Bldg., Chicago; the Dravo-Doyle Co., Dravo Bldg., Pittsburgh; A. Q. Dufour, Merchants and Manufacturers Bank Bldg., Milwaukee; the Florandin Equipment Co., 110 W. 40th St., New York; the Fulton Engineering Co., 612 American Bank Bldg., San Francisco; S. A. Gilliard, 405 Liberty Bldg., Buffalo; the E. C. Horne Machinery Co., 1751 Wazee St., Denver; the J-B Engineering Sales Co., New Haven; the Lyman Tube & Supply Co., Montreal; J. H. Purser, 406 Commercial Bank Bldg., Charlotte, N. C.; the Seeger Machine Tool Co., 260 Luckie St., Atlanta; Solon Jacobs & Co., 420 S. 20th St., Birmingham, Ala.; the P. E. Wright Engineering Co., 2012 L. C. Smith Bldg., Seattle. The American Engineering Co. manufactures shipbuilding machinery.

The John B. Black Co., Chester, Pa., has been purchased by a syndicate headed by Philip E. Wright and Clifton B. Drake of Philadelphia.

The Oswego Tools Works, Oswego, N. Y., has purchasd the business of the Atlas Vise Co. and the Velox Vise Co. of Lowville, N. Y. and will move the business of the two plants to Oswego, N. Y. Edwin W. Fulton of Lowville who has been in control of the two companies will become works manager of the Oswego Tool Works, succeeding Benjamin W. Dow, who has resigned.

The Therman Electric Corp., Cincinnati, has been incorporated with a capitalization of $150,000. F. E. Davis is president of the company and Edward B. Harris, treasurer. The plant will be established at 613 East Front St.

The Reliance Manufacturing Co. was recently incorporated at New Haven, Conn., to carry on the business formerly owned by the Reliance Air Spring Company. The capital stock is $400,000. The incorporators are: John F. Moran, 785 Forest Road; Louis Lear, 340 Orange St.; and C. B. Swebilius, 131 Eagle St., all of New Haven.

Obituaries

GEORGE W. HAMPSHIRE, manager of the Detroit office of the Colonial Steel Co., Pittsburgh, died recently. He was 47 years of age and had been with the company for the past six years.

VERNON LEE, manager of the Weldless sales division of the American Chain Co., Bridgeport, Conn., died at St. Vincent's Hospital, Bridgeport, Conn., Friday, Aug. 15, of blood poisoning.

CHARLES E. D. TIBBITS, aged 90 years, died recently at Murray Bay, Quebec. He was formerly president of the Walter A. Wood Mowing & Reaping Machine Co., Hoosick Falls, N. Y. His home was in Troy, N. Y.

HOWARD B. WILLIAMS, Detroit, manager of the Ferry Cap & Set Screw Co., died at his home in Detroit of influenza-pneumonia.

HARRY P. DARCHE, owner of the Ace Auto Spring Works of Buffalo, died recently. Mr. Darche was born in Toronto in 1872 and had been in business in Buffalo many years. He was a member of the Engineering Society of Buffalo.

Forthcoming Meetings

American Railway Tool Foremen's Association. Annual convention, Sept. 3, 4 and 5. Hotel Sherman, Chicago, Ill. J. A. Duca, C. R. I. & P. Railway, Shawnee, Okla.

International Railway General Foremen's Association. Annual convention, Sept. 9, 10, 11 and 12. Hotel Sherman, Chicago, Ill. William Hall, 1061 W. Wabash Ave., Winona, Minn.

New Haven Branch of the American Society of Mechanical Engineers. Fourth annual machine tool exhibit, Sept. 15-18. Mason Laboratory, New Haven, Conn. H. R. Westcott, chairman.

American Society for Steel Treating. Sixth Convention, Boston, Mass., Sept. 22, 23, 24, 25 and 26. W. H. Eisenman, secretary, 4600 Prospect Ave., Cleveland, Ohio.

National Safety Council. Thirteenth Annual Safety Congress. Louisville, Ky. Sept. 29 to Oct. 3. W. H. Cameron, managing director, 168 N. Michigan Ave., Chicago.

Motor and Accessory Manufacturers' Association. Annual meeting, Cleveland, Ohio, Week of Oct. 6.

American Foundrymen's Association. Twenty-eighth annual convention. Milwaukee, Wis. Week of Oct. 13, 1924.

National Industrial Advertisers Association. Annual meeting, Edgewater Beach Hotel, Chicago, beginning Oct. 13, 1924.

Management Week. Under the auspices of the American Society of Mechanical Engineers. Week of Oct. 20, 1924. New York City.

American Gear Manufacturers Association. Semi-annual fall meeting. Briarcliff Lodge, Briarcliff Manor, N. Y., Oct. 16, 17 and 18. T. W. Owen, secretary, 2443 Prospect Ave., Cleveland, Ohio.

American Society of Mechanical Engineers. Forty-fifth annual meeting. New York City. Dec. 1 to 4. Calvin Rice, secretary, 29 West 39th St., New York City.

National Exposition of Power and Mechanical Engineering. Grand Central Palace, New York City, Dec. 1 to 4. Charles F. Roth, 1102 Grand Central Palace Building, New York City.

Exposition of Invention. Engineering Societies Building, 29 West 39th St., New York City, Dec. 8 to 13 inc., General offices, 47 West 34th St., New York City.

The Weekly Price Guide

Rise and Fall of the Market

Iron and Steel—Pig-iron production increasing gradually; quotations unchanged from last week. Iron demand slight although inquiries are numerous. Weakness continues in market for heavy rolled products, particularly plates. More of a tendency is being shown at present to purchase for replenishment of steel warehouse stocks. There is active inquiry for rails and car material. Quotations on principal hot-rolled products, follow: bars, $2.10@$2.15; shapes, $1.95 @$2.15 and plates, $1.75@$2 per 100 lb. Pittsburgh.

Non-Ferrous Metals—Copper market improving; foreign demand greater. Tin demand better; prices higher abroad. Lead firm at present levels. Zinc quiet; prices ¼c. per lb. above Aug. 15. Antimony stronger; better foreign demand. Copper, lead, zinc and antimony all higher than a week ago.

Other Materials—Linseed oil up 2c. per gal.; red and white lead, ¼c. per lb., f.o.b., New York, Aug. 20. Wiping cloths ¼c. per lb. higher.

(All prices as of Aug. 22)

IRON AND STEEL

PIG IRON—Per gross ton—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$22.05@22.55
Northern Basic	20.00
Southern Ohio No. 2	21.77
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	28.05
BIRMINGHAM	
No. 2 Foundry	18.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	22.77@23.27
Virginia No. 2	28.44@29.44
Basic	20.00@21.00
Grey Forge	21.00@22.00
CHICAGO	
No. 2 Foundry local	20.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	28.05
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	25.00
Basic	25.00
Bessemer	28.66

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4.50@4.75
Cleveland	4.75@5.00
Cincinnati	5.00@7.50
New York	5.00@5.50
Chicago	5.25@5.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh Mill Base	New York	Cleveland	Chicago
No. 10	2.60@2.70	3.89	3.55	3.80
No. 12	2.70@2.80	3.94	3.60	3.95
No. 14	2.80@2.90	3.99	3.65	4.00
No. 16	3.00@3.10	4.09	3.75	4.10
Black				
Nos. 17 and 21	3.35	4.40	4.25	4.55
Nos. 22 and 24	3.40	4.45	4.30	4.55
Nos. 25 and 26	3.45	4.50	4.35	4.60
No. 28	3.50	4.60	4.45	4.50
Galvanized				
Nos. 10 and 11	3.50@3.60	4.60	....	4.60
Nos 12 and 14	3.60@3.70	4.70	....	4.70
Nos. 17 and 21	3.90@4.00	5.00	....	5.00
Nos. 22 and 24	4.05@4.15	5.15	5.00	5.15
No. 26	4.20@4.30	5.30	5.25	5.30
No. 28	4.50@4.60	5.60	5.55	5.50

WROUGHT PIPE (Welded)—Warehouse discounts are as follows:

	New York		Cleveland		Chicago	
	Black	Galv.	Black	Galv.	Black	Galv
1 to 3 in. steel butt welded.	48%	34%	55½%	43½%	56%	43%
2½ to 6 in. steel lap welded.	44%	30%	53½%	40½%	53%	40%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4%; class A, plus 23%. Cast iron, standard sizes, 36% off.

SEAMLESS STEEL TUBING—Following base discounts are on 20 gauge or .035-in., round, cold-drawn tubing, ¼-in. to 1-in., O.D., weighing 0.17 lb. to 0.36 lb. per ft. Cutting charge per 100 cuts, $1.50 to $1.58:

O.D. Inches	List Price per ft.	Differential Discount	O.D. Inches	List Price per ft.	Differential Discount
¼	$0.09	50%	⅞	$0.16	35%
⅜	.11	45%	1	.18	31%
½	.14	40%			

NOTE—The discounts are to be lowered by the following differentials in the case of regular .10-.20 carbon: 25,000 ft. or over, 83; 15,000 to 25,000 ft., 82; 5,000 to 15,000 ft., 81; 1,000 to 5,000 ft., 80; less than 1,000 ft., 79.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.20
Spring steel (light) (base)	7.00	6.00	6.00
Coppered Bessemer rods (base)	7.50	8.00	6.55
Hoop steel	4.49	3.96@4.36	4.15
Cold rolled strip steel	7.00	8.25	7.15
Floor plates	5.55	4.60	5.50
Cold drawn shafting or screw	4.15	4.00	3.80
Cold drawn flats, squares	4.65	4.50	4.30
Structural shapes (base)	3.34	3.21	3.10
Soft steel bars (base)	3.24	3.11	3.00
Soft steel bar shapes (base)	3.24	3.21	3.00
Soft steel bands (base)	3.99	3.61	3.65
Tank plates (base)	3.34	3.43½	3.10
Bar iron (2.90@3.00 at mill)	3.24	3.21	3.00
Tool steel	11.00	....	....
Drill rod (from list)	60%	40@55%	50%

Electric welding wire, New York, 5/32, 8.35c.; ⅛, 7.85c.; 5/32 to ¼, 7.35c. per lb.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York	14.25		
Tin, 5-ton lots, New York	53.37½@53.50		
Lead (up to carlots), St. Louis	8.12½	New York	8.62½@8.75
Zinc (up to carlots), St. Louis	6.25	New York	7.25@7.37½

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	27.10	28.00	28.50
Antimony (Chinese), ton spot	11.50@12.00	13.00	10.00
Copper sheets, base	20.37½	20.50@21.25	23.00
Copper wire, base	18.75	19.00	21.75
Copper bars, base	19.62½	22.25	22.50
Copper tubing, base	22.75	28.00	25.75
Brass sheets, base	17.00	21.75	19.75
Brass tubing, base	21.50	28.00	28.25
Brass rods, base	14.75	17.75	17.50
Brass wire, base	17.50	21.75	20.25
Zinc sheets (casks)	10.25	10.75	....
Solder (½ and ½), (case lots)	37.50	35.00	30.00
Babbitt metal (83% tin)	60.00	62.50	48@52
Babbitt metal (35% tin)	28.00	18.50	23@26
Nickel (ingot and shot) f.o.b. refinery	27.00	....	....
Nickel (electrolytic) f.o.b. refinery	30.00	....	35.00
Nickel (F shot) f.o.b. refinery	30.00	....	....

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Rolled nickel sheet (base)	52.00
Hot rolled rods, Grade "A" (base)	50.00
Cold drawn rods, Grade "A" (base)	58.00

Shop Materials and Supplies

METALS—Continued

Manganese nickel hot rolled rods "E"—low manganese (base) 54.00
Manganese nickel hot rolled rods "D"—high manganese (base) 57.00

Base price of monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled rods (base)	40.00
Blocks	32.00	Cold drawn rods (base)	48.00
Ingots	38.00	Hot rolled sheets (base)	42.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	10.75@11.25	10.25	9.50@10.00
Copper, heavy, and wire	10.50@11.00	10.00	11.00
Copper, light, and bottoms	9.50@10.00	8.50	8.00@8.25
Lead, heavy	6.25@6.75	5.00	5.00@5.50
Lead, tea	5.25@5.75	3.00	3.00@3.25
Brass, heavy, yellow	6.75@7.00	8.75	6.00
Brass, heavy, red	8.50@8.75	5.00	7.50
Brass, light	5.75@6.00	4.75	5.00
No. 1 yellow brass turnings	7.25@7.50	5.75	6.00
Zinc	3.75@4.00	3.75	4.00

TIN PLATES—American Charcoal—Bright—Per box.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	20x28, 112 sheets	$23.50	$22.85	$21.00
"A" Grade:				
IC,	20x28, 112 sheets	19.00	18.00	17.00
	Coke Plates—Primes, 20x28 in.			
100-lb.,	112 sheets	13.00	13.00	12.75
	Terne Plates—Small lots, 8-lb. Coating			
IC,	14x20	7.75	6.55	6.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.14@0.21	$0.20	$0.14
Cotton waste, colored, per lb.	.09@.14½	.17	.10½
Wiping cloths, 13½x13½, per lb	11.50*	36.00 per M	.16
Wiping cloths, 13½x20½, per lb.	....	52.00 per M	.16
Sal soda, per 100 lb.	2.40	2.25	2.65
Roll sulphur, per 100 lb.	3.60	3.25	3.50
Linseed oil, per gal., 5 bbl. lots	1.07	1.16	1.05
Lard cutting oil, 25% lard, per gal.	.55	.50	.32
Machine lubricant, medium-bodied (50 gal. wooden bbl.), per gal.	.29	.35	.21
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 24c. per lin. ft. per inch of width for single ply.			
Medium grade	40–2½%	30–10%	30–10%
Heavy grade	30–5%	30%	20–5–2½%
Rubber transmission:			
First grade	50%	50–10%	40–10%
Second grade	50–10%	60–5%	60–5%
brasive materials—In sheets 9x11 in.,			
No. 1 grade, per ream of 480 sheets:			
Flint paper	$4.86	$5.84	$6.48
Emery paper	10.71	11.00	8.80
Emery cloth	28.00	31.12	29.48
Emery disks, 6 in. dia., No. 1 grade, per 100:			
Paper	1.49	1.24	1.40
Cloth	3.38	2.67	3.20
Fire clay, per 100 lb. bag	....	.65	.60
Coke, prompt furnace, Connellsville	per net ton		3.00@3.25
Coke, prompt foundry, Connellsville	per net ton		4.25@4.75
White lead, dry or in oil	100 lb. kegs		New York, 14.75
Red lead, dry	100 lb. kegs		New York, 14.75
Red lead, in oil	100 lb. kegs		New York, 16.25

*White, at washery.

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0324	$0.0334	$0.0354
Cold finished shafting	per lb.	0.0415	0.0425	0.044
Brass rods	per lb	0.1475	0.14	0.1675
Solder (½ and ½)	per lb.	0.375	0.3375	0.295
Cotton waste	per lb.	.14@.21	.14@.21	.10@.13
Washers, cast iron (½ in.)	per 100 lb.	6.50	6.50	6.50
Emery, disks, cloth, No. 1, 6 in. dia.	per 100	3.38	3.38	3.38
Lard cutting oil	per gal.	0.55	0.55	0.55
Machine oil	per gal.	0.29	0.29	0.297
Belting, leather, medium	off list	40–2½%	40–2½%	30–10%
Machine bolts up to 1x30 in.	off list	50%	50%	30%

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	50%	60–10–5%	60%
1½ and 1½x3 in. up to 12 in.	15%	.....	....
With cold punched hex. nuts up to 1 in. diam. (plus std. extra of 10%)	40%	$3.50 net	60%
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	45%	3.50 net	60%
Button head bolts, with hex. nuts	10%	List net	.....
Hex. head and hex. nut bolts	10%	.....	.....
Lag screws, coach screws	50%	.....	65%
Square and hex. head cap screws	75%	75%	.....
Carriage bolts, up to 1 in. x30 in.	40%	60%	55%
Bolt ends, with hot pressed nuts	50%	.....	60%
Tap bolts, hex. head, list plus	35%	.....	$4.65
Semi-finished nuts, ⅛ and smaller	70%	.....	.....
Semi-finished nuts, ¼ and larger	65%	70%	.....
Case-hardened nuts	50%	.....	.....
Washers, cast iron, ½ in., per 100 lb. (net)	$6.50	$4.00	$3.75
Washers, cast iron, ¼ in., per 100 lb. (net)	5.50	4.00	3.75
Washers, round plate, per 100 lb. Off list	1.50	4.50	4.50
Nuts, hot pressed, sq., per 100 lb. Off list	1.50	4.00	4.00
Nuts, hot pressed, hex., per 100 lb. Off list	1.50	4.00	4.00
Nuts, cold punched, sq., per 100 lb. Off list	1.50	4.00	4.00
Nuts, cold punched, hex., per 100 lb. Off list	1.50	4.00	4.00
Rivets:			
Rivets, ⅛ in. dia. and smaller	50%	60–10%	70%
Rivets, tinned	50%	60–10%	70%
Button heads ¼-in., ⅜-in., 1x2 in. to 5 in., per 100 lb. (net)	$5.00	$3.50	$3.50
Cone heads, ditto (net)	5.20	3.60	3.70
1½ to 2-in. long, all diameters, *EXTRA* per 100 lb.	0.25	.....	0.15
¼ in. diameter *EXTRA*	0.35	.....	0.15
⅜ in. diameter *EXTRA*	0.75	.....	0.50
1 in. long, and shorter *EXTRA*	0.75	.....	0.50
Longer than 5 in. *EXTRA*	0.50	.....	0.25
Less than 200 lb. *EXTRA*	0.50	.....	0.50
Countersunk heads *EXTRA*	0.45	.....	....

Machine Requirements and Industrial Construction

Machine Tools and Equipment Wanted

Conn., New Britain—Vulcan Iron Works, 63 John St.—equipment for annealing room for malleable iron castings and one 5-ton travelling crane.

Mass., Boston—J. Beal & Co., 465-471 Atlantic Ave., 50 power presses similar to 18-19-20 and 21 Bliss or equal.

Mass., Boston — Stone & Webster — one electric overhead crane, one 20 ton locomotive crane for Luzerne County Gas & Electric Corp., Hunlock, Pa.

N. Y., Angelica—E. E. Travis Co.—equipment and machinery for sawmill.

Tex., Dallas—C. Smith, 3614 Noble Ave. —equipment for saw mill.

Wis., Black River Falls—Jackson Box Co., Wm. Schofield, Purch. Agt.—wood working machinery, including sticker.

Wis., Marinette—M. & M. Box Co., Homer St., c/o H. Greene, 559 Marshall St., Milwaukee, Pres.—power saws, belting and shafting.

Wis., Milwaukee—Central Board of Purchases, City Hall, J. Nicholson, Purch. Agt.—one 3 ft. radial drill.

Wis., Sheboygan Falls—Normal School Bd., Sheboygan County, c/o A. Weinick, Plymouth — manual training equipment, bench tools, etc., for new Training School.

N. B., St. John—The Admiral Beatty Garage Ltd., G. A. Camerson, Purch. Agt. —complete equipment for large garage and automobile repair shop.

Ont., Chatham—City Council, A. Sulman, Mayor, Chairman of Committee—tools and other equipment for vocational school $50,000.

Ont., Hamilton—Coulter Wood Products Co.—machinery and equipment for wood working plant.

Ont., Lakefield—The Lakefield Brass and Metal Works—machinery and tools for new plant.

Ont., North Bay — Standard Planing Mills, Ltd., Main St. East,—machinery for planing mill.

Ont., Parry Sound—E. G. Groves—vulcanizing equipment, small tools, lathe.

Ont., Parry Sound—Parry Sound Garage Co., Gilbron St., W. D. Quinn, Purch. Agt., —Fire repair equipment, drill press, etc.

Ont., Utterson—J. Pascall—drill press, forge and small tools.

Ont., St. Catherine—Reed, Art Furniture Builders, Ltd., c/o B. N. Trapnell, Purch. Agt.—complete machinery for new factory.

Ont., Toronto—The Roamer Motor Car Co. of Canada, Atlantic Ave., Toronto—equipment for plant for building automobile bodies.

Ont., Washago—A. H. Cot—drill press, vulcanizer, etc.

Que., Montreal — E. F. Shufelt, 6536 Western Ave.,—general shop equipment, including forge, drill press and lathe for auto repair shop.

Opportunities for Future Business

Ariz., Phoenix—The Atchison, Topeka & Santa Fe R.R. Co., Kerckhoff Bldg., Los Angeles, Calif., plans the construction of shop buildings, estimated cost $75,000 to $100,000.

Calif., Los Angeles—Tidewater Oil Corp., 940 E-2nd St., has awarded the contract for the construction of a 1 story, (ultimate 2) 125 x 190 ft. garage and offices on 48th St., and Long Beach Ave.

Calif., Oakland—Chicago Lumber Co. of Washington, Hearst Bldg., San Francisco, awarded the contract for the construction of a planing mill on 68th Ave., cost $22,000.

Calif., San Diego—Potter Radiator Corp., 5946 Pasadena Ave., Los Angeles, are having plans prepared for the construction of a factory, cost will exceed $100,000.

Calif., Westwood—Red River Lumber Co., Monadnock Bldg., San Francisco will build a 160 x 800 ft. veneer plant.

Conn., Bristol—The E. Ingraham & Co., 392 North Main St., manufacturer of clocks and watches, plans the construction of a 5 story, 65 x 200 ft., 80 x 80 ft. additions to its factory on N. Main St., estimated cost, $40,000 at least. H. A. Hayden, 175 Main St., Archt.

Conn., New Britain—Vulcan Iron Works, will receive bids until Aug. 29th for 3 story, 80 x 277 ft., 80 x 100 ft. L factory buildings, also an annealing building, estimated cost $100,000. M. J. Unkelbach, New Britain, Archt.

Conn., Norwich—A. M. Pasnik, 79 William St., awarded the contract for the construction of a 1 story, 160 x 200 ft. garage on Shetucket St., estimated cost $150,000.

Conn., Wallingford—The Paulson Tools, Inc., awarded the contract for the construction of a 1 story, 36 x 80 ft. forge and machine shop, estimated cost, $15,000.

Ga., Atlanta—The Southern R.R. Co., Washington, D. C., has awarded the contract for double transverse erecting and machine shops for locomotives, estimated cost, $750,000.

Md., Baltimore—Board of Fire Commissioners, plan the construction of repair shop at Key Highway and Webster St., estimated cost, including equipment, between $65,000 and $100,000.

Md., Baltimore—Goodwill Industries, Inc., 207 South Broadway, will receive bids until September 1st for the construction of a 5 story, 40 x 80 ft. factory on Pratt St. and Broadway, estimated cost, $65,000. C. M. Anderson, East Pleasant St., Archt.

Md., Baltimore—Montgomery, Ward & Co., Chicago Ave., and Larre St., Chicago, are having plans prepared for the construction of a 3 story plant on Lincoln Highway, estimated cost $2,000,000. Wm. H. McCaully c/o Owner, Engr.

Mass., Marlboro—Marlboro Wire Goods Co., awarded the contract for the construction of a 3 story, 70 x 150 ft. manufacturing building, cost $155,000.

Mo., St. Louis—Eighteenth Street Realty Co., 312 North Eighth St., awarded the contract for the construction of a 4 story garage on 18th St., estimated cost, $750,000 and up. Klipstein & Rathmann, Chemical Building, St. Louis, Archt.

Mo., St. Louis—Missouri Portland Cement Co., Post Despatch Bldg., awarded the contract for the construction of a 1 story 51 x 165 ft., 27 x 146 ft. garage, stables and warehouse buildings on Wharff & Tyler St., estimated cost, $150,000. Mauran, Russell & Crowell, Chemical Bldg., Archts.

N. Y., Buffalo—The Worthington Pump & Machinery Corp., Roberts St., has had plans prepared for the construction of a 1-story, 50 x 75 ft. factory addition. Estimated cost, $45,000. The company is in the market for equipment and machinery for the manufacture of steam pumps.

O., Cleveland—Columbian Hardware Co., 1296 E. 53rd St., had plans prepared for the construction of a 1 story, 90 x 201 ft. factory, estimated cost $50,000.

O., Cleveland — H. Helper, c/o G. A. Ebeling, Hunkin-Conkey Bldg., Cleveland, Archt. had plans prepared for the construction of a 2 story, 50 x 80 ft. factory on 4040 East Superior Ave., estimated cost $40,000.

O., Cleveland—A. J. Orkin, 3623 Central Ave., awarded the contract for the construction of a 2 story, 44 x 75 ft. sheet metal factory on East 36th St., estimated cost, $40,000.

O., Columbus—E. A. Prentice Lumber Co., Vine and Armstrong Sts., E. A. Prentice, Purch. Agt., 4 stickers, 2 cut off saws, 3 planers, 2 combination woodworking machines.

Okla., Oklahoma City—Security National Bank, 109 N. Broadway, plans the construction of an 8 story, 50 x 140 ft. garage Architect not announced.

Pa., Latrobe—Vanadium Alloys Steel Co., awarded the contract for the construction of a 1 story, 70 x 260 ft. hammer shop and boiler house.

Pa., Philadelphia — Cutter Electric & Manufacturing Co., awarded the contract for the construction of a 4 story, 53 x 85 ft. manufacturing plant on Hamilton and 19th St.

Pa., Sharon—National Malleable Castings Co., awarded the contrace for the construction of a 1 story, 100 x 190 ft. machine shop on South Dock St., estimated cost, $200,000. Private plans.

R. I., Hillsgrove—Rhode Island Malleable Iron Works, awarded the contract for the construction of a 120 x 140 ft. foundry, estimated cost $60,000.

Wis., Milwaukee — The George Meyer Manufacturing Co., 576 Clinton St., is having plans prepared by A. H. Kienappel, Archt., 445 Milwaukee St., for the construction of a 1-story, 50 x 60 ft. brass foundry. Estimated cost, $40,000.

Wis., Racine—Reliance Automatic Lighting Co., B. L. Flegel, Pres., 510 College Ave., are having plans prepared for the construction of a 2 story 50 x 60 ft. factory, estimated cost $40,000. A. L. Flegel, c/o Owner, Engr.

Wis., Wauwatosa—Forsyth Leather Co., State St., awarded the contract for the construction of an addition to machine shop, 40 x 60 ft., estimated cost $25,000. Cahill & Douglas, 217 W. Water St., Milwaukee, engr.

Ont., Hamilton—Coulter Wood Products Co., plans to rebuild plant, destroyed by fire.